FLIGHT

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

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EDITORIAL COMMENT.

Germany's Aerial Predicament.

The passage of yet another week of war by land, water and air has served to lift the veil in most interesting fashion on various phases of the aerial situation. Thus from official sources we have been informed not only of the scope of the work being done by the Naval Branch of our Air Service, but also of an extraordinary situation that seems to have arisen in regard to the German air service. We refer to the hint contained in the eye-witness's account from the British General Headquarters in France dealing with the operations in the last week of September, and to the fact that the hostile artillery fire has decreased in volume and deteriorated alike in control and direction, the two latter being possibly a direct result of the activity of our aircraft and their interference with the enemy's aerial reconnaissance and observations of fire. "Recently the Germans have been relying to some extent on observations from captive balloons sent up at some distance in rear of their first line, which method, whatever its cause, is a poor substitute for the direct overhead reconnaissance obtainable from aeroplanes," continues the report. These are remarkable words, particularly when we have in mind the confessions of certain military members of the French aerial forces to the effect that in the early days of the war they were as inclined to under-estimate the German aerial prowess as the Germans in their turn were inclined to under-estimate the power and efficiency of the French Army. The French were quick to learn the lesson and to adapt themselves to the German Aerial Arm, not as they had imagined it to exist before the outbreak of war, but as they actually found it in war, with the result that the French themselves speedily obtained a personal ascendancy over the German airmen, even as our own did at a somewhat earlier date, and possibly in large measure because we had been full modest about our own prowess, which had given rise to suggestions that in going abroad we were to be matched against army pilots if anything a shade superior to our own from the strictly military points of view. That the fact has been otherwise has formed as well the subject of well-earned tribute in every quarter of the country, as provided matter for honest pride to our modest military officers.

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"Not Enough to Go Round?"

These things being so, the Allies have accounted for a much greater number of German aviators than they have sustained losses themselves. Therefore the necessity has arisen in the western theatre of operations for our enemies to make still more strenuous efforts in the direction of aerial *personnel* to oppose the British and French flying forces, which have been increasing constantly in efficiency since the outbreak of war by reason of the evergrowing gain of experience. How comes it about, therefore, that in a war which it is admitted has already taught us to reconstruct our military ideas to such an extent that henceforth artillery must be regarded as the premier land weapon, nevertheless the Germans are allowing that weapon to be comparatively inefficient by handicapping it through begrudging it the co-operation of aerial observers working with aeroplanes, and are instead falling back on what can only be described nowadays as the very antique and old-fashioned method of observation by captive balloon sent up at some distance in rear of the first line? It can have only one meaning, namely, that despite the amazing efforts she has made, Germany has not enough pilots to go round. You cannot make *personnel* of this sort in a day. Certainly if she had the necessary number of men she would never fail to use them in such operations as the Battle of the Aisne, which has been the longest waged in history and

which can have no secrets for the commander who has at his disposal an adequate aerial arm. If we consider a little, however, we may arrive at the matter in more detail than this, and discover that there is a why and a wherefore in Germany's thus sacrificing her artillery's efficiency in districts on the grounds officially specified. We must bear in mind that during the last fortnight the German authorities have been making still greater use of their amazing strategic railway systems for taking their soldiers on excursions, for this has undoubtedly been a campaign of railway excursions. Masses of troops seem no sooner to be brought to one centre than they are shifted to another and their places taken by yet others. *No unit seems to be allowed to remain long in any one area, with the result that vast numbers have been withdrawn from the scenes of the most strenuous operations* for quite appreciable periods during the waging of these struggles. In other words, you can perchance make too much use of your railway systems for moving troops from point to point in the middle of a campaign.

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Still Exploiting the Doctrine of Necessity.

Be that as may be, however, we know for certain that the cream of the German Army is now opposed, not to France, but to Russia. Into the wisdom of that move from a military point of view, we need not enquire, because it is a mere dictation of necessity. Germany must therefore take the chance of her first line, which has been well shattered in France, where it has learned that it is not invincible, but only able to fail of obtaining its objective according to programme, having enough nerve left and sufficient remaining confidence in her officers and system to face the Russians, of whom the rank and file of Germans have always entertained fears as lively as the contempt in which they held the French and British forces previous to the outbreak of this war. For us, in our consideration of the aerial phases of the campaign, it matters merely that with Germany's first line go the pick of her aerial service, who are therefore being employed now rather against Russia than against France and Britain. There has been no official announcement to this effect. But such occurrences as that officially recorded in the terms referred to above can only mean that Germany is short of military pilots, and is therefore using the pick of her aerial forces, not in the west, where she cannot hope to get the aerial mastery of the enemy, but in the east, where she assumes that her enemy has no equivalent *personnel* with which to match her. The argument, too, is no bad one. Russia has to import the bulk of her aerial armament, apart from which it is but a natural assumption that after two months of war the Germans must have learned at least something from making contact with the French and British aerial forces, and therefore have some substantial reason in conjecturing that such knowledge may be mighty useful when employed against the Russians. Furthermore, in the Austro-German operations against the Russians, vastly greater numbers are being employed than in the western theatre of war. It therefore follows that the proportion of aviators to land forces engaged is on both sides in the eastern theatre vastly less than on the British and French sides in the west. Indeed it is up to us and our Ally to help the Russians to the utmost of our power in the Aerial Arm, for the outstanding lesson, as we always anticipated would be the case, of this war to date is that, provided you possess sufficient aerial arms, the enemy *can spring no surprises on you.*

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Attempting to Surprise Russia.

Germany knows that she can spring no surprises on us in the west, but she hopes to spring surprises on the Russians in the east, or, at the least, to prevent the Russians springing any surprises on her. In fact, though the war is only two months old, there are sound grounds for concluding that Germany is beginning to find herself in a cleft stick in an aerial sense, as well as regards her military operations on land. The further she goes the tighter is the corner in which she finds herself. The fact that she can produce as many aeroplanes and motors as she requires does not solve the problem. You must besides have ample supplies of fuel, and in that direction she is getting in a very tight corner indeed. Further than that is the problem of producing the *personnel.* It is one thing to be a good civilian cross-country flier, and quite another to be an aerial observer of real worth. Of course, in her predicament Germany must be content to make good her losses, or even to endeavour to increase her Aerial Arm, by employing all classes of civilian flyers in combination with expert military observers. But that is a game at which two, and even more, can play. Britain, France and Russia have all their plans made full well ahead towards this end. Therefore, from the point of view of the Aerial Arm, the campaign has speedily reached an intensely interesting stage. It is not unreasonable to expect Germany to enjoy some appreciable advantage in aerial reconnaissance, if not actual attack, against Russia from now on, but that will be offset by the corresponding advantages the Allies will enjoy in the western theatre of operations. Whether or not it will be possible at a later stage so to assist Russia as completely to turn the scales in regard to the Aerial Arm of the Austro-German forces is matter of speculation at the moment, therefore we shall not indulge in it, being instead concerned solely with actual occurrences in the course of this mighty and revolutionary campaign.

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Round the World Race Cancelled.

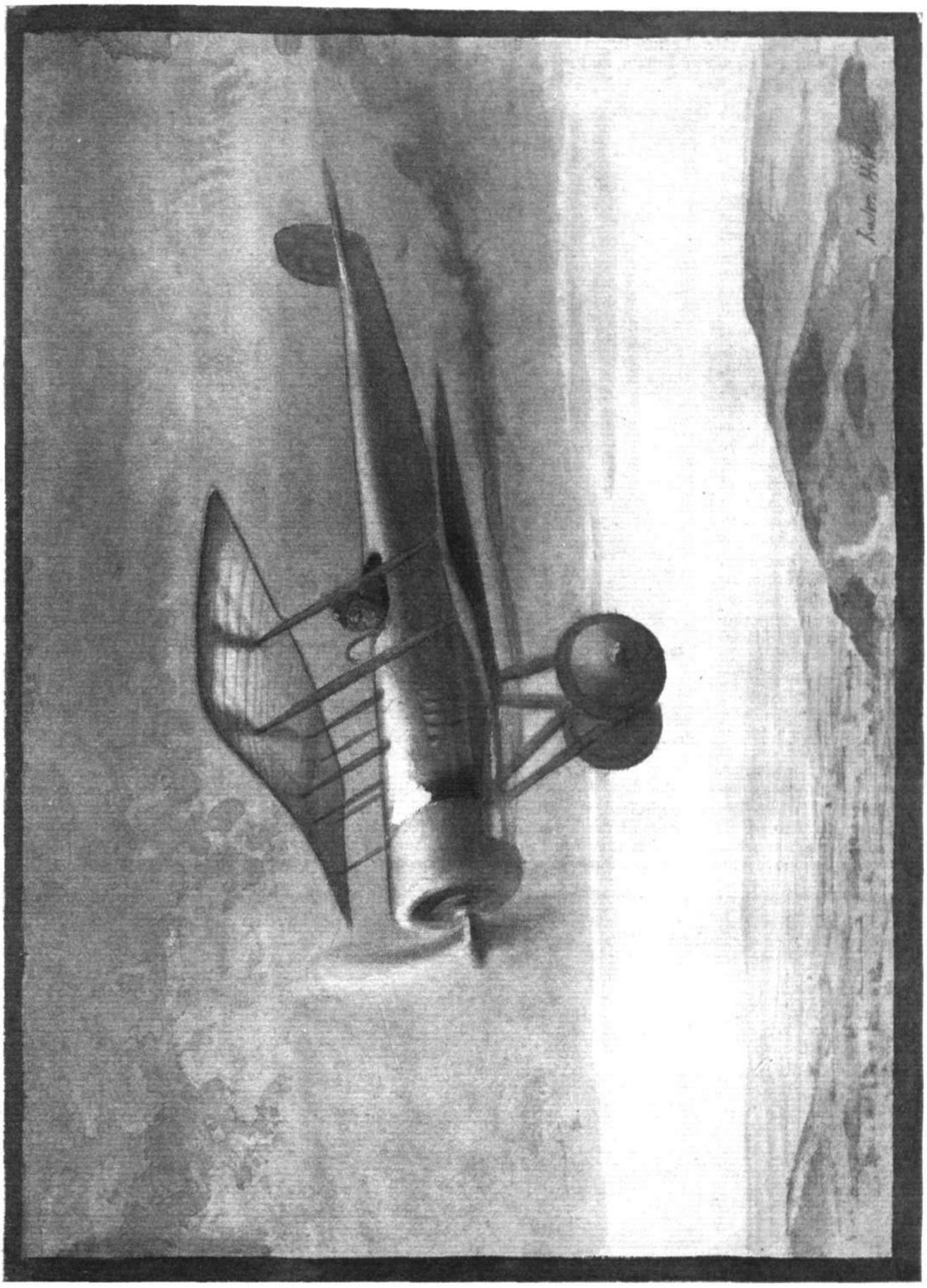
ACCORDING to a message from New York, it has been decided to cancel the round the world race, which was to have been held next year in connection with the Panama-Pacific Exposition. The reason given for this action is that all the foreign entries have been withdrawn.

Chinese Aeroplanes at Tsingtao.

IN a letter dated August 28th, Mr. Herbert Chatley, who is a Professor at the Chinese Government Engineering College, Tangshan, North China, and on whom the University of London recently conferred the Degree of Doctor of Science (Engineering), mentions that the Chinese have sent two Caudron biplanes to Tsingtao to watch the siege.

Lectures on Aero Engines.

ARRANGEMENTS have been made by the Faculty of Engineering at King's College, London, for a series of ten lectures by Mr. G. A. Burls, on "Modern Explosive Engines used in Automobiles and Aircraft." The lectures will be given on Thursdays at 6 p.m., commencing Oct. 8th. Drawing and design classes in connection with the course will be held on Thursdays from 2 to 5 p.m.



"THE FAST SCOUT IN WAR TIME."—From an original drawing by Roderic Hill.

THE "ROUND BRITAIN" MACHINES.

THE seaplane for which Mr. Loftus Bryan had been nominated pilot in the circuit of Britain, and which had been officially numbered 9, was

The White and Thompson Flying-Boat.

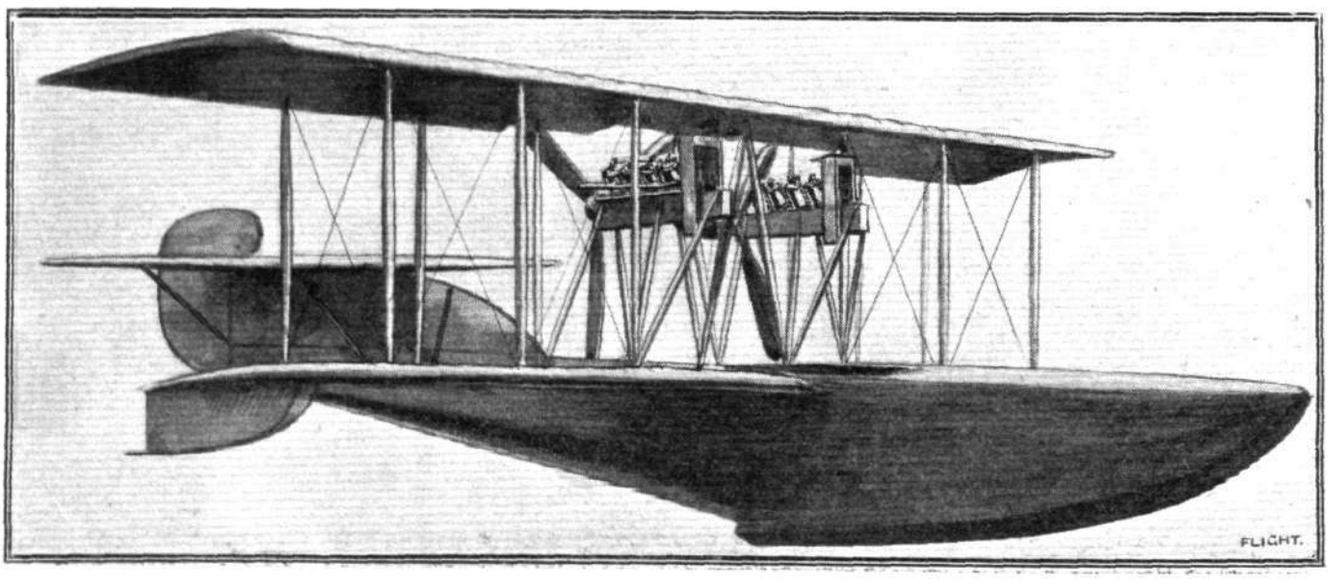
As regards the general disposition of its component parts this machine adheres fairly closely to the practice followed in the original American Curtiss flying boats, but the greater portion of the detail work has undergone alteration and modification with the object of improving, both aerodynamically and constructionally, upon its American prototype.

Aerodynamically the greatest improvement has possibly been effected in the shape of the wing section, which is a reproduction of the famous R.A.F. 6, that has proved so efficient both under laboratory tests and on full-sized machines. In plan the wings are of rectangular form and the upper plane has a very pronounced overhang braced by steel tubes running to the bases of the outer interplane struts. The balancing flaps are hinged to the outer portion of the upper rear spar and not, as in the original Curtiss, to the plane struts. Consistent with modern practice, the flaps are inter-connected, so that when one is depressed the other is correspondingly elevated. The spars of the lower main plane pass through the boat, to which they are further stayed by four steel tubes running from the plane struts immediately outside the engines to the sides of the boat.

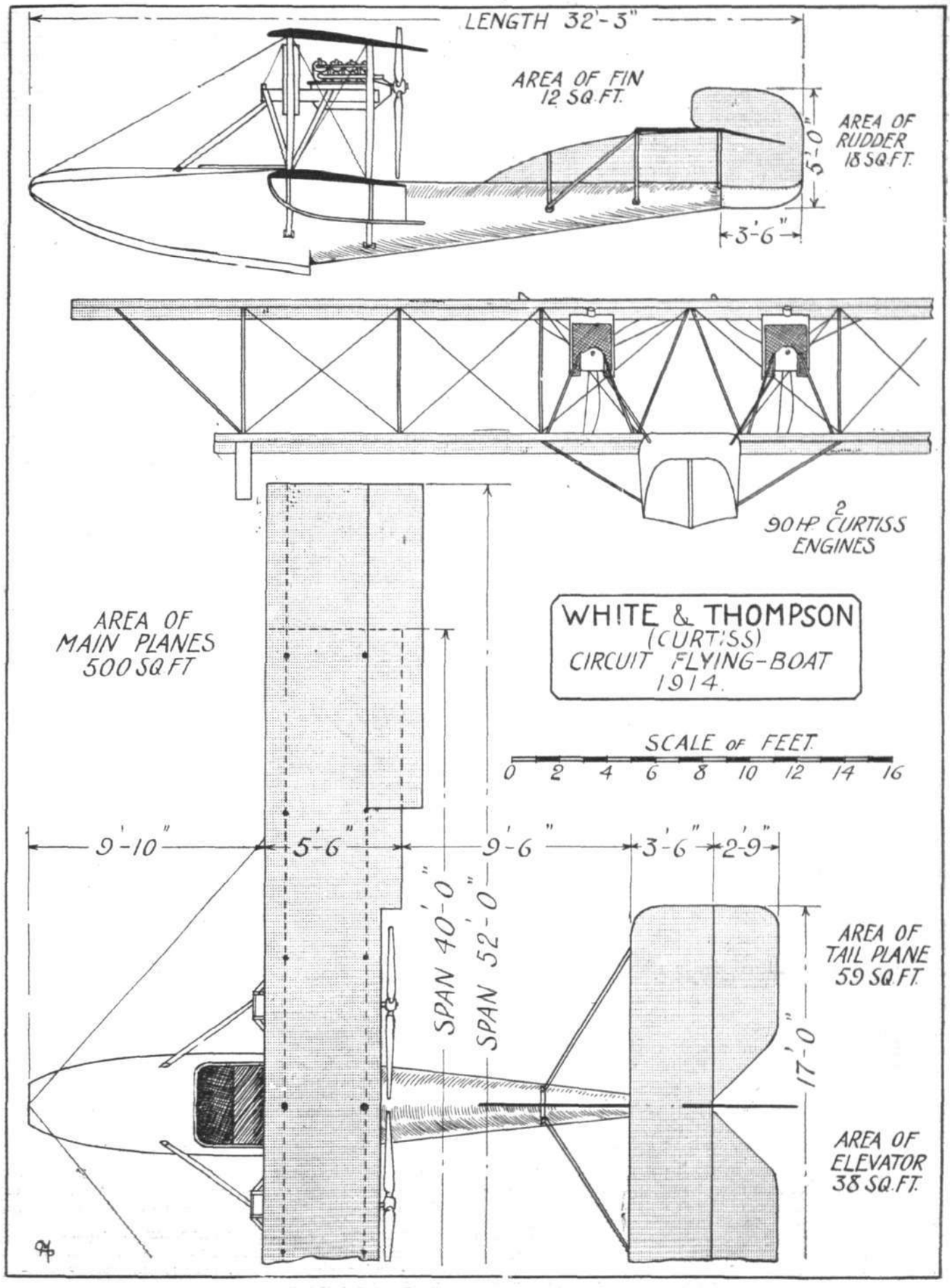
Mr. A. Loftus Bryan, the nominated pilot for the White and Thompson flying boat, No. 9.

Instead of running vertically from top to bottom plane the inner pair of interplane struts form an inverted V as seen from in front, so that their upper apices meet on the centre line of the upper plane. Between the planes and spaced about 8 ft. apart are mounted two Curtiss engines of the OX model, each of 90 h.p. and driving a three-bladed propeller with adjustable pitch. The method of mounting these engines is the same as that employed when only a single motor is fitted, and consists, as our readers will remember from previous descriptions of Curtiss machines, of stout engine bearers of ash supported on a structure of steel tubes resting with their lower extremities on the spars of the lower main plane. In front of the engines are mounted the two radiators, which in this machine are placed astride the engine bearers. The engines are braced forward by means of two struts running to the keel of the boat some distance behind the bow. As the engines are not enclosed in any way, they are easily accessible should it become necessary to effect minor adjustments.

The boat or hull, which has been built by Messrs. Williams and Co. of Littlehampton, is of approximately rectangular section in front, whilst gradually running into



ROUND BRITAIN MACHINES, No. 9.—The White and Thompson (Curtiss) flying boat.



ROUND BRITAIN MACHINES, No. 9.—The White and Thompson flying boat. Plan, side and front elevations to scale.

a circular section at the rear. Being about 4 ft. deep and of practically the same beam, it affords ample accommodation for pilot and passenger, who sit side by side just in front of the leading edge of the main planes. Curtiss control of the usual dual type is fitted, so that either of the occupants can pilot the machine. Behind the seats and inside the boat is placed the petrol tank, which has a capacity of 90 gallons, or sufficient for a flight of 6 hours' duration.

The tail planes are of the usual Curtiss form, but are slightly larger in size than those fitted on the single-engined machines. A vertical fin resting on the top of the rear circular portion of the boat, to which it is braced by means of steel tubes, provides the fixed vertical surface aft. To the trailing edge of this fin is hinged a large rudder, which has a small forward extension above the fixed stabilising plane. The lower part of the rudder is covered with metal for the sake of protection. The large horizontal tail plane is mounted on top of the vertical fin and braced by tubes to the boat. A divided elevator hinged to the rear edge of the tail plane completes the tail unit.

The weight of the machine empty is 2,000 lbs., and with full load, including pilot, passenger and 6 hours' fuel, 3,000 lbs.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Special Committee Meeting.

A SPECIAL MEETING of the Committee was held on Tuesday, the 6th inst., when there were present :—Prof. A. K. Huntington, in the Chair, Mr. Griffith Brewer, Mr. Ernest C. Bucknall, Mr. C. F. Pollock, and the Assistant Secretary.

New Members.—The following New Members were elected :—John Kenneth Rankin, Vivian Findlay Smith, and Richard Minshull Spencer Veal.

Aviators' Certificates.

The following Aviators' Certificates were confirmed :—

907 Flight Sub-Lieut. Philip Leslie Holmes, R.N.A.S. (Avro Biplane, Central Flying School, Upavon). Sept. 21st, 1914.

908 John Callaghan Brooke (Blériot Monoplane, Military School, Brooklands). Sept. 21st, 1914.

909 Claude Francis Strickland, I.C.S. (Grahame-White Biplane, Grahame-White School, Hendon). Sept. 22nd, 1914.

910 James Gordon McKinley (Blériot Monoplane, Military School, Brooklands). Sept. 22nd, 1914.

911 Flight Sub-Lieut. Bernard Crossley Meates, R.N.A.S. (Maurice Farman Biplane, Central Flying School, Upavon) Sept. 23rd, 1914.

912 Harry O'Hagan (Blériot Monoplane, Military School, Brooklands). Sept. 23rd, 1914.

913 Oswald Mansell Moullin (Bristol Biplane, Military School, Brooklands). Sept. 24th, 1914.

914 2nd Lieut. Frederick William Polehampton (14th Cavalry Reserve, 15th Hussars) (Grahame-White Biplane, Grahame-White School, Hendon). Sept. 27th, 1914.

915 Reginald Lord (Wright Biplane, Beatty School, Hendon). Sept. 27th, 1914.

916 Flight Sub-Lieut. Maurice Arthur Haines, R.N.A.S. (Grahame-White Biplane, Grahame-White School, Hendon). Sept. 30th, 1914.

917 Flight Sub-Lieut. Harold Rosher, R.N.A.S. (Grahame-White Biplane, Grahame-White School, Hendon). Sept. 30th, 1914.

918 Gerald Charles Ross Mumby (Grahame-White Biplane, Grahame-White School, Hendon). Oct. 1st, 1914.

919 Flight Sub-Lieut. Francis Warrington-Strong, R.N.A.S. (Grahame-White Biplane, Grahame-White School, Hendon). Oct. 2nd, 1914.

920 Lieut. Arthur Bracton Bagley (Royal Dublin Fusiliers) (Maurice Farman Biplane, Central Flying School, Upavon). Oct. 2nd, 1914.

The following Aviators' Certificates were granted :—

921 Capt. Harold Wyllie (9th Hampshire (Cyclist) Battalion), (Maurice Farman Biplane, Royal Flying Corps, Netheravon). Sept. 1st, 1914.

922 2nd Lieut. William Francis Forbes Sempill, R.F.C. (Maurice Farman Biplane, Central Flying School, Upavon). Sept. 29th, 1914.

923 Charles Henry Chichester Smith (Wright Biplane, Beatty School, Hendon). Oct. 2nd, 1914.

924 Lieut. Eric Walker (6th Battalion Border Regiment) (Maurice Farman Biplane, Military School, Brooklands). Oct. 4th, 1914.

American Certificate.

307 Griffith Brewer (Wright Biplane, Wright Station, Dayton, Ohio). Aug. 15th, 1914.

British Empire Michelin Cup No. 2 and £800.—The following letter from the Michelin Tyre Company was read :—

"Dear Sir,—We beg to acknowledge receipt of your favour of the 10th inst., addressed to Mr. Wolff, with regard to the postponement of the competition for the 1914 British Empire Michelin Cup No. 2.

"Mr. Wolff is at present absent from London, having rejoined his regiment in France, but we are confident that he would be quite in agreement with the decision arrived at by your Committee, and willing to allow the prize to stand over for competition when circumstances permit.

"Yours faithfully,
(Signed) "P. BERNARD, Manager."

B. STEVENSON, Assistant Secretary.

166, Piccadilly, W.

The Lights of London.

THE following order still further restricting the amount of light allowed in London was issued through the Press Bureau on Monday night :—

"The Secretary of State for the Home Department, under the powers conferred on him by Regulation 7a of the Defence of the Realm Regulations, 1914, has made an order, which contains the undermentioned provisions :

"In all brightly-lighted streets and squares and on bridges a portion of the lights must be extinguished, so as to break up all conspicuous groups or rows of lights ; and the lights which are not so extinguished must be lowered or made invisible from above by shading them or by painting over the tops and upper portions of the globes, provided that while thick fog prevails the normal lighting of the streets may be resumed.

"Sky signs, illuminated facias, illuminated lettering, and powerful lights of all descriptions used for outside advertising or for the illumination of shop fronts must be extinguished.

"The intensity of the inside lighting of shop fronts must be reduced.

"In tall buildings which are illuminated at night the greater part of the windows must be shrouded, but lights of moderate brightness may be left uncovered at irregular intervals.

"All large lighted roof areas must be covered over or the lighting intensity reduced to a minimum.

"Lights along the water front must be masked to prevent as far as practicable the reflection of the light upon the water.

"The aggregation of flares in street markets or elsewhere is prohibited.

"In case of a sudden emergency, all instructions given by the Admiralty or by the Commissioner of Police on the advice of the Admiralty, as to the further reduction or extinction of lights, shall be immediately obeyed.

"The order applies to the City of London and the whole of the Metropolitan Police district, and to the hours between sunset and sunrise, and it will be in force for one month from October 1, 1914, unless sooner revoked.

"E. R. HENRY,
"The Commissioner of Police of the Metropolis."

FLIGHT

AIRCRAFT WORK AT THE FRONT.

The following references to aircraft were made in the despatch from headquarters issued by the Press Bureau on the 2nd inst. :—

"Further, the hostile artillery fire has decreased in volume and deteriorated both in control and direction. The first is probably due to a transfer of metal to other quarters, but the two latter may be a direct result of the activity of our aircraft, and their interference with the enemy's air reconnaissance and observation of fire.

"Recently the Germans have been relying to some extent on observation from captive balloons sent up at some distance in rear of their first line, which method, whatever its cause, is a poor substitute for the direct overhead reconnaissance obtainable from aeroplanes. As a consequence, the damage being done to us is wholly disproportionate to the amount of ammunition expended by the enemy. . . . .

"In the hazy valleys, bathed in sunlight, not a man, not a horse, not a gun, nor even a trench was to be seen. There were only flashes, smoke, and noise. Above, against the blue sky, were several round white clouds hanging in the track of the only two visible human souls —represented by a glistening speck in the air. On high, also, were to be heard the more or less gentle reports of the bursts of the anti-aircraft projectiles. . . .

"The troops in second line at certain spots pass the time by punting a football about on the village 'places.' It is rumoured that a German aviator who observed this sent in a report that the British forces were thoroughly disorganised and running about their post in blind panic."

On the 2nd inst. the following record of the splendid work accomplished by the Royal Naval Air Service was issued by the Secretary of the Admiralty through the Press Bureau :—

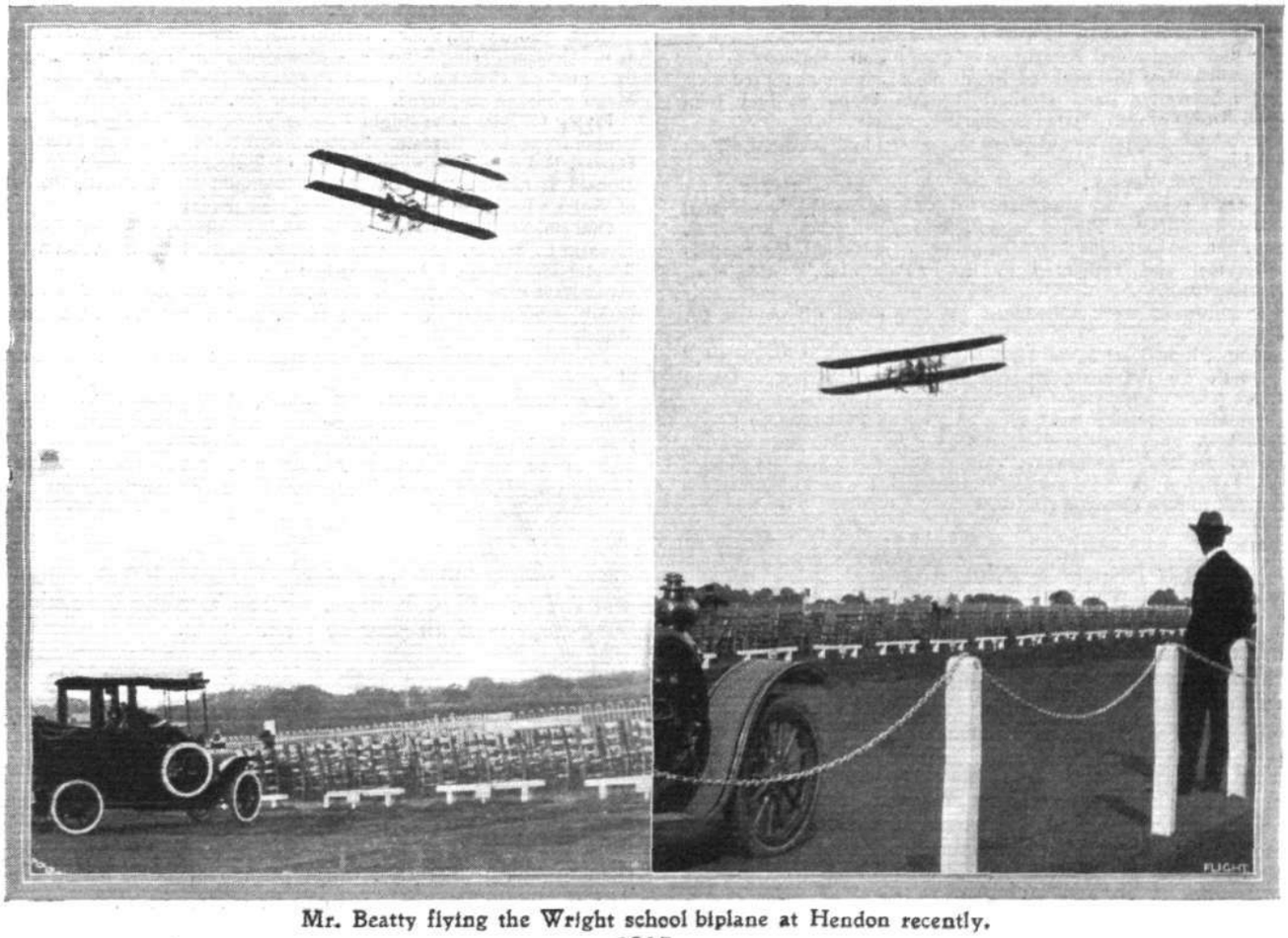
"During the course of the war the Royal Naval Air Service (Naval Wing of Royal Flying Corps) has not been idle, airships, aeroplanes, and seaplanes having proved their value in many undertakings.

"While the Expeditionary Force was being moved abroad a strong patrol to the eastward of the Straits of Dover was undertaken by both seaplanes and airships of the Naval Air Service. The airships remained steadily patrolling between the French and English coasts, sometimes for twelve hours on end ; while further to the east, with the assistance of the Belgian authorities, a temporary seaplane base was established at Ostend, and a patrol kept up with seaplanes between this place and the English coast opposite.

"By this means it was impossible for the enemy's ships to approach the Straits without being seen for very many miles.

"On one occasion, during one of the airship patrols, it became necessary to change a propeller blade of one of the engines. The captain feared it would be necessary to descend for this purpose, but two of the crew immediately volunteered to carry out this difficult task in the air, and climbing out on to the bracket carrying the propeller shafting, they completed the hazardous work of changing the propeller's blade, 2,000 ft. above the sea.

"On August 27th, when Ostend was occupied by a



Mr. Beatty flying the Wright school biplane at Hendon recently.

force of marines, a strong squadron of aeroplanes, under Wing Commander Samson, complete with all transport and equipment, was also sent over, the aeroplanes flying thither *viâ* Dover and Calais.

"Advanced bases have been established some distance inland, and on several occasions skirmishes have taken place between armed motor-car support and bands of Uhlans.

"All these affairs have been successful, with loss to the enemy in killed and prisoners. The Naval armed cars and aeroplanes have also assisted French forces of artillery and infantry on several occasions.

"During the course of these actions the following officers and men of the Royal Naval Air Service, Royal Marines, and Royal Naval Volunteer Reserve are reported as having been wounded :—

"Capt. Cuthbert Williams, R.M.A., slightly wounded.
Sub-Lieut. Alexander Nalder, R.N.V.R., wounded.
Pte. Charles Farrant, R.M.L.I., O.N. Portsmouth 8883, slightly wounded.
Pte. Harper, armourer, seriously wounded.
Leonard William Walsh, A.B., seriously wounded.

"All the wounded are doing well.

"Commander Samson has performed distinguished services in this work. Captain Williams, R.M.A., is also mentioned as having shown much coolness and capability in a difficult situation.

"Air reconnaissance by the Naval airmen has extended for considerable distances into the enemy's country.

"Squadron Commander Gerrard is in command of a detached squadron of aeroplanes, and his machines have crossed the Rhine and made the attack on Düsseldorf previously reported.

"Good work has been done in dropping bombs on positions of military importance and railway communications."

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THE BRITISH AIR SERVICES.

Royal Naval Air Service.

THE following promotions were announced in the *London Gazette* of the 2nd inst. :—

The undermentioned probationary Flight Sub-Lieutenants have been confirmed in the rank of Flight Sub-Lieutenant, and promoted to Flight Lieutenant: Hugh Clarence Fuller. Dated August 28th, 1914. Arthur Nickerson. Dated September 14th, 1914. William Hayland Wilson. Dated September 15th, 1914.

The undermentioned probationary Flight Sub-Lieutenants have been confirmed in the rank of Flight Sub-Lieutenant: John Philip Wilson, Harry Stewart, Denys George Murray, Eric Bentley Baumann, George Bentley Dacre, Norman Sholto Douglas, Ralph James Jean Hope-Vere, and Ralph Whitehead. Dated September 16th, 1914.

The undermentioned Acting Flight Lieutenants have been confirmed in the rank of Flight Lieutenant: Lancelot Tomkinson and Geoffrey Rhodes Bromet. Dated August 1st, 1914.

The undermentioned Probationary Flight Sub-Lieutenants have been confirmed in the rank of Flight Sub-Lieutenant: Frederick Melville Llewellyn Barr, Herbert Graham Wanklyn, and John Marten Rush Cripps. Dated August 1st, 1914.

The following appointments were announced by the Admiralty on the 3rd inst. :—

Allan K. Robertson, entered as Flight Sub-Lieutenant, for temporary service, and appointed to the "Pembroke," additional for Eastchurch Naval Flying School, September 30th. Rupert E. Penny, entered as Flight Sub-Lieutenant on probation, for temporary service, and appointed to the "Pembroke," additional, September 30th.

The following were announced by the Admiralty on the 5th inst. :—

Acting Flight-Lieutenant H. Delacombe to the "Pembroke," additional, for Farnborough Naval Airship Station. Dated October 5th.

The undermentioned have been entered as Probationary Flight Sub-Lieuts., and appointed as follows: E. J. M. Bird and T. Spencer, to the "Pembroke," additional, for course of flying; G. W. Price, to the "Pembroke," additional, for course of instruction. All to date October 5th.

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Royal Flying Corps (Military Wing).

THE following appointments were announced in a supplement to the *London Gazette* issued on the 1st inst. :—

Supplementary to Regular Corps.—To be Second Lieuts. (on probation); Oct. 1st, 1914: Albert T. Crick, Cyril M. Crowe, Robert M. Pike.

The following correction appeared in the *London Gazette* of the 2nd inst. :—

The appointments of the undermentioned are those of Deputy Assistant Adjutant and Quartermaster-General, and not as notified in the *Gazette* of August 25th, 1914: Brevet Major H. R. M. Brooke Popham, the Oxfordshire and Buckinghamshire Light Infantry, and Lieutenant B. H. Barrington-Kennett, Grenadier Guards.

The following were announced in a supplement to the *London Gazette* issued on the 3rd inst. :—

Capt. Andrew G. Board, South Wales Borderers (an Instructor at the Central Flying School), is advanced from Flight Commander to Squadron Commander, and is granted the temporary rank of Major whilst so employed. September 9th, 1914.

Flying Officers to be Flight Commanders, and to be granted the temporary rank of Captain. September 16th, 1914: Lieut. Leonard Dawes, Duke of Cambridge's Own (Middlesex Regiment), Lieut. Donald S. Lewis, R.E., and Lieut. Reginald G. D. Small, Prince of Wales's Leinster Regiment (Royal Canadians).

Officers, Special Reserve, to be Flying Officers: Second Lieut. Horatio C. Barber. August 12th, 1914. Second Lieut. William B. Rhodes-Moorhouse. August 24th, 1914.

Supplementary to Regular Corps.—Second Lieutenants (on probation) confirmed in their rank: H. C. Barber and W. B. Rhodes-Moorhouse.

The following appointments were announced in the *London Gazette* of the 6th inst. :—

Capt. (temp. Maj.) Herbert Musgrave, R.E., from a Dep. Asst. Director at the War Office, to be a Squadron Commander. September 15th, 1914. Flying Officers advanced to Flight Commanders, and to be temp. Capts.: August 7th, 1914—Lieut. Walter Lawrence, 7th Batt. Essex Regt., and Lieut. Philip B. Joubert de la Ferté, R.A.

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Mr. Griffith Brewer a Pilot.

FROM the official notices of the Royal Aero Club it will be seen that Mr. Griffith Brewer, who is one of the pioneers in aeronautical work in Great Britain and is well known for his work in connection with the Wright Brothers, qualified for his pilot's *brevet* during his last trip to the Wright headquarters at Dayton, Ohio.

Flying to Court.

HAVING to appear at Pewsey Police Court as a witness, on Monday, Lieut. Gould, R.F.C., flew over from Netheravon on his machine, explaining to the magistrate that as he expected to be ordered to the front at any moment he did not wish to be away from headquarters longer than necessary. He added that it took him ten minutes to fly there, whereas it would have taken three-quarters of an hour by road.

A New Bomb and a Camera.

AT a meeting of the Academy of Sciences held in Paris on the 22nd ult., reference was made to a new projectile designed for use by aviators. Although details were withheld, it was stated already some marvellous work had been accomplished with the new bomb. Mention was also made of a new camera, which although used at high altitudes, takes photographs in which the details of military positions can be clearly seen.

FLIGHT

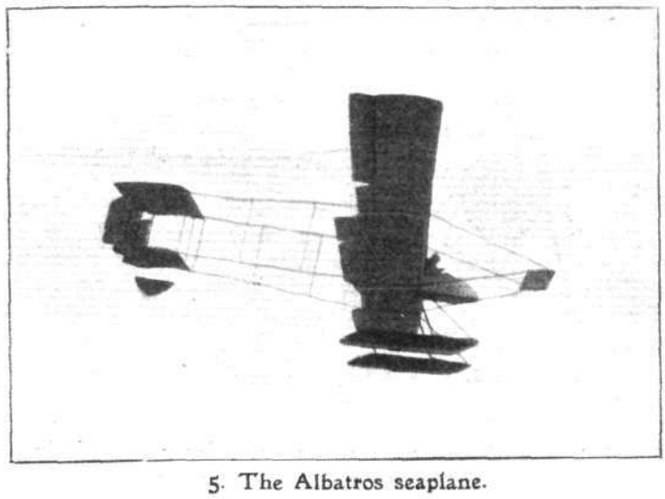
AIRCRAFT "MADE IN GERMANY"

WHICH MAY BE EMPLOYED AGAINST THE ALLIES.

(*Continued from page* 978.)

5. The Albatros Propeller Seaplane

is of an older type, and the firm is, we believe, discontinuing building this type. The main planes, which are of rectangular plan form, are of large span, and both upper and lower planes are fitted with *ailerons*. Pilot and passenger are accommodated side by side inside a short shallow *nacelle*, and dual control is fitted, or, more correctly speaking, the single control wheel can be shifted from side to side so that either of the occupants may pilot the machine. A front elevator of the Farman type is fitted, and at the rear, carried on an outrigger of the usual form, is a biplane tail. Between the upper and lower tail planes are mounted three vertical rudders side by side, and to the trailing edge of the upper tail plane is hinged the rear elevator. The engine—a 100 h.p. Argus or Mercedes—is mounted at the rear of the *nacelle*, and in front of it, supported on the engine bearers, is the radiator.

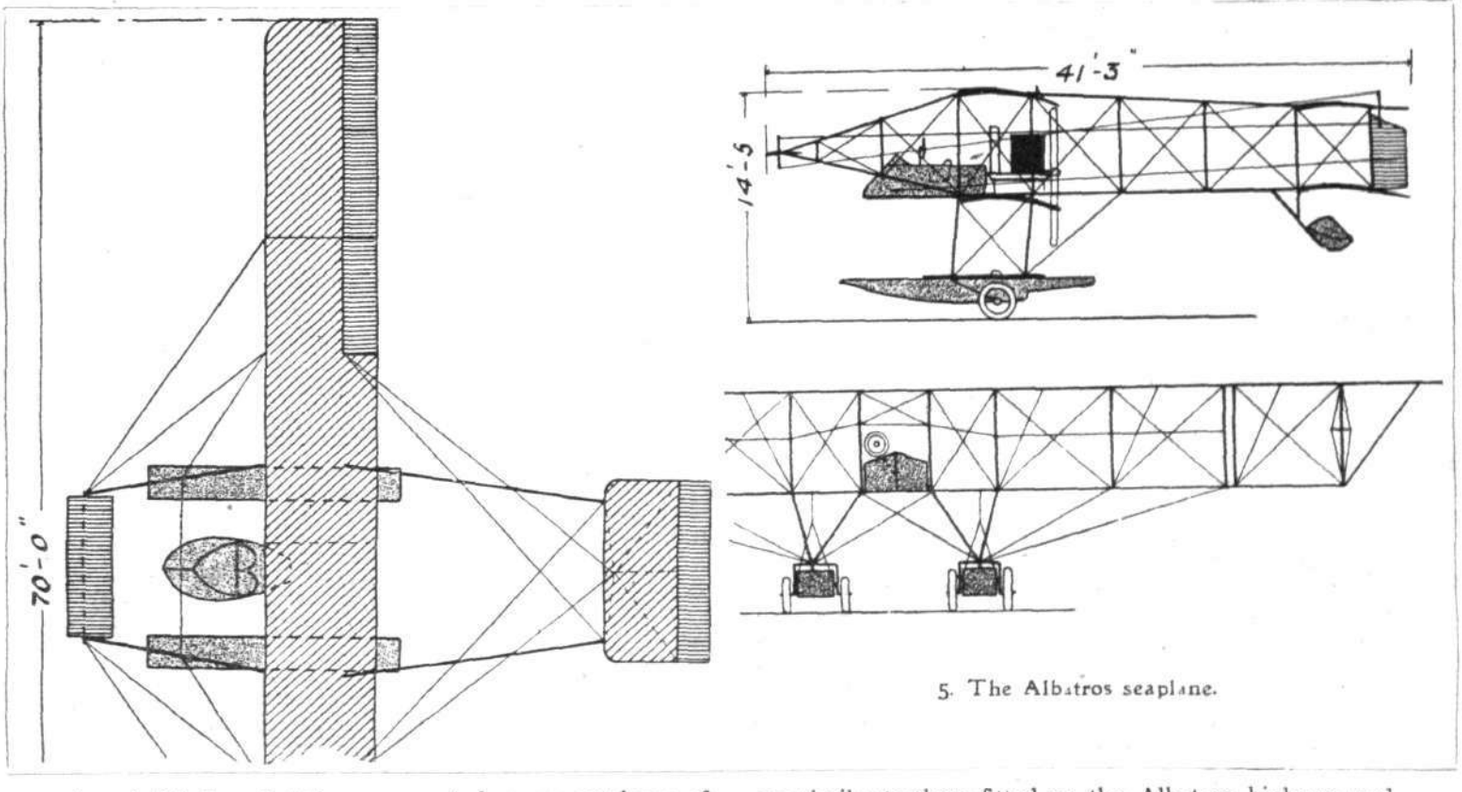


5. The Albatros seaplane.

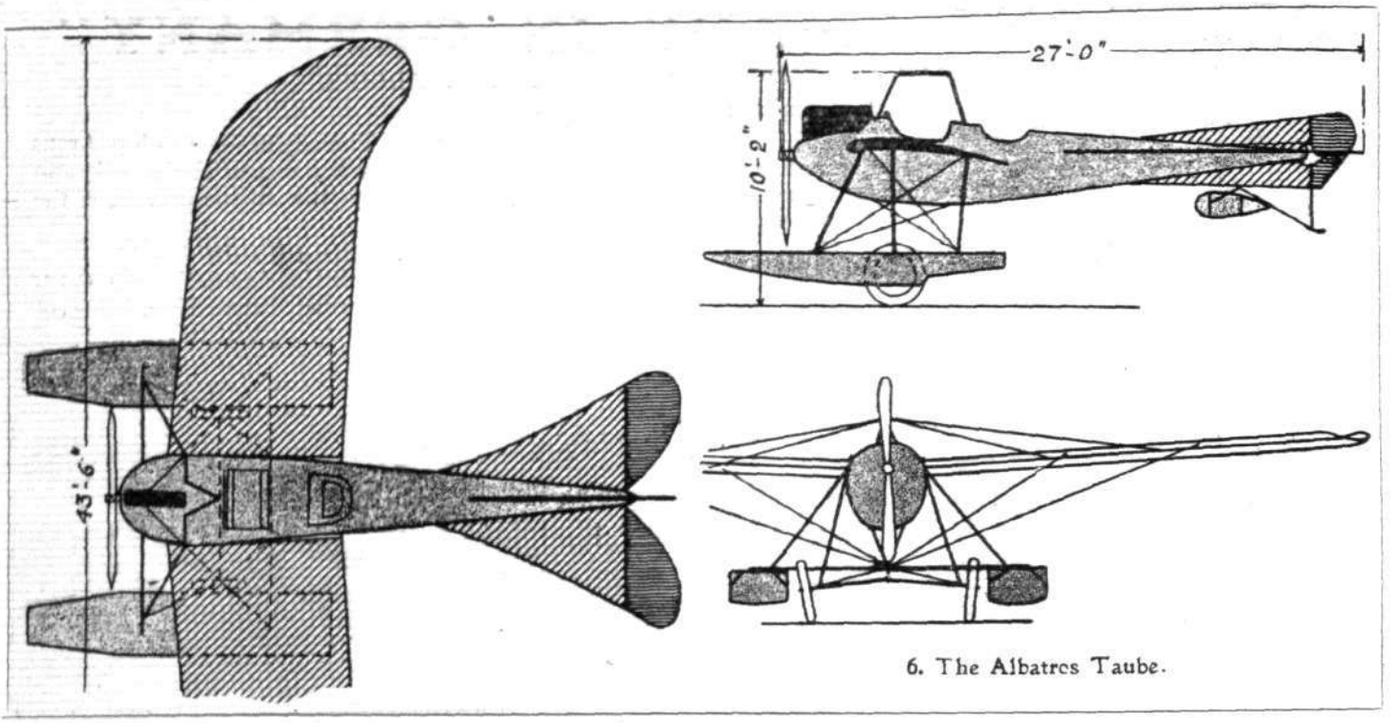
6. The Albatros Taube

is of the type used in the Lake Constance Race in 1913. Its main planes are of the usual Taube type, being of Zanonia form. The body is of particularly good streamline form, having no sharp angles in its outline. Pilot's and passenger's seats are arranged in tandem as in the land machines, and just in front of the passenger is mounted a 100 h.p. Mercedes engine. The tail planes are similar to those fitted on the Albatros biplanes, and consist of a horizontal stabilising plane, to which is hinged the divided elevator, and of vertical fins above and below the body, to which is hinged the rudder. As

6. The Albatros Taube.



5. The Albatros seaplane.



6. The Albatros Taube.

is the case with the majority of German seaplanes, this machine is amphibious, being fitted with a combined land and water chassis. The two wheels, which are placed between the floats, can be raised clear of the water and lowered again at will by means of a lever in the passenger's cockpit. The two floats, which are of the single stepped type, are built up of two skins of mahogany over an ash framework and are carried on a structure of streamlined steel tubes.

7. The Albatros Tractor Seaplane

is practically identical with the land machines, with the exception of course that floats are fitted. These, which

7. The New Albatros Tractor seaplane.

are of the non-stepped type, are sprung from the chassis struts by rubber shock absorbers which are enclosed in streamlined casings, partly to reduce head resistance and partly in order to protect them against the effect of salt water. The body, which is of rectangular section, is covered with three-ply wood in the same manner as the land machines flown by Thelen at Hendon some time ago. The seats are arranged in tandem, the pilot sitting at the rear, from where he obtains a good view in a downward direction further enhanced by leaving the inner portion of the trailing edge of the lower plane uncovered. In front of him, and protected by a mica wind-screen, is the passenger, situated immediately behind the 160 h.p. Mercedes engine, which is mounted in the nose of the body. Long exhaust pipes carry the exhaust gases away over the side of the body. The weight of the tail planes is taken when the machine is at rest by a peculiarly shaped float mounted underneath the rear portion of the body. The wheels shown in the illustration do not form part of the chassis, but are part of a transport trolley attached to the floats by strong steel straps.

8. The Aviatik Seaplane

is a tractor biplane of the usual *fuselage* type. The main planes, of which the upper one is of slightly larger span than the lower one, are of rectangular plan form, and are separated by four pairs of steel tube struts. The two halves of the upper plane are joined to a monoplane type of *cabane*, the four tubes of which are secured to the

8. The Aviatik Tractor seaplane.

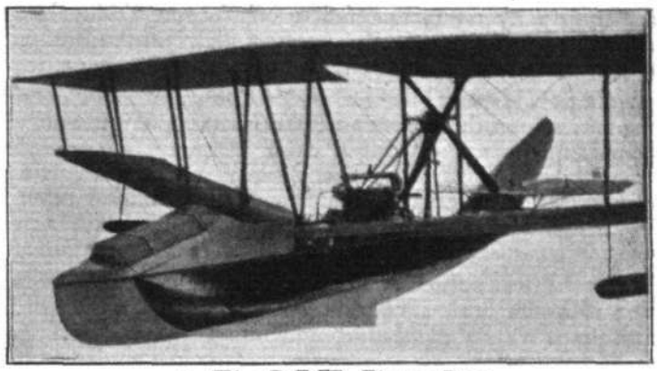
upper longitudinals of the body. In the nose is mounted the 190 h.p. Argus motor, access to which is gained through inspection doors in the aluminium covering of the front portion of the body. Further back, and on each side of the body, are mounted the two radiators. Pilot and passenger sit behind one another, tandem fashion, the pilot occupying the rear seat. A large main float is carried on a very simple structure of steel tubes, and the lateral stability of the machine when on the sea is increased by two smaller auxiliary floats supported on steel tubes from the lower main plane.

9. The D.F.W. Flying Boat

is somewhat reminiscent, as regards the boat itself, of the Curtiss flying boat. The main planes, however, are entirely different from those of the Curtiss, being of the Arrow type. The lower main plane, in addition to its

backward slope, is set at a very pronounced dihedral angle, partly to increase the lateral stability and partly to provide sufficient water clearance. The engine—a 100 h.p. Mercedes—is mounted well down in the hull and drives the propeller through bevel gearing. The two seats are arranged side by side inside the boat and just in front of the lower main plane. In front of the occupants the deck slopes steeply upwards so as to form a wind-screen, and on it is mounted the radiator. A step of comparatively great depth occurs approximately under the centre of gravity of the machine. Two small cylindrical floats protect the lower main plane against contact with the water.

(*To be concluded.*)



9. The D.F.W. Flying Boat.

EDDIES.

SOME interesting news is to hand from Australia from A. W. Jones, who took his "ticket" at Hendon on a Caudron some time back. After his exhibitions round about Melbourne on his 35 h.p. Caudron, he shipped the latter across the Bight to Perth, where he was booked up to give some flights. On arriving at Perth he thought it advisable to take down his engine, as he finds that sea air penetrates to almost every part no matter how carefully protected, and any salt that may be deposited is not likely to do any good if left to rest. In due course the engine was reassembled, and a new cylinder fitted, and pilot and machine proceeded to the exhibition ground—Perth Oval. Arrangements had already been fixed up without consulting him, and when he saw the Oval he said it was practically impossible to fly there, but as it had been advertised that flights would take place he said he would make an attempt. So he started off and just managed to clear some telegraph wires "by inches"—he said he could almost feel the tail strike and bump over. His troubles were not at an end, however, for he was struck by the full force of the wind and his engine not pulling well he was obliged to descend on a neighbouring racecourse. The "gate" was naturally disappointed, but was promised a full display in the near future.

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It was almost like old times up at Hendon last Saturday week, for the weather was ideal, and there was a small but interested "gate," whilst several machines were to be seen out on the aerodrome. It is true they were mostly Government craft, but this, under existing state of affairs, rather added to the interest of the stunts, although there was no megaphone man to announce the name of the pilot and make of machine. The first out was E. Prosser on his Caudron, on which he put up some really fine turns. A 100 h.p. Gnome (Monosoupape) Sopwith "pusher" biplane then made its appearance, and after getting through a couple of circuits of the aerodrome—climbing well—it made off in the direction of Eastchurch. Next came a 100 h.p. Anzani Sopwith tractor biplane ("Circuit" type), which was followed by "multi-coloured Joseph," the 120 h.p. Austro-Daimler R.E. biplane. Both, after climbing for a few circuits, followed the first Sopwith. After this Prosser made another flight, and school work started on the Maurice Farman "Short-horn" (Merriam up), G.-W. 'bus, Avros, and Wright (Beatty up).

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Later in the evening some excitement was caused by one of the G.-W. pupils, who was making his first circuit. He was about to land when he noticed the Maurice Farman in his way, so he started to climb again with a series of "hoiks" and just managed to clear the sheds. His next move was even more startling, for he suddenly made a left-hand banked turn *à la* Chevillard and then looked as if he was going to do a *chute de côté* on to the "Atlantic" shed. However, he just cleared this and somehow or other managed to straighten out and land with safety in the aerodrome. "Did you see that stunt?" was his remark on landing! Well, it was one of the closest shaves I have seen at Hendon, but he got out of it splendidly, and is the sort of "stuff" for making pilots. May I add that he wears the uniform of the "King's Navee."

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The Grahame-White works are going "all out" building machines, and in spite of the fact that they are somewhat hampered as regards space, this go-ahead firm is turning out machines at a good rate. The output per week will, moreover, be considerably improved in the near future, for the huge hangar originally intended for the "Atlantic 'Bus" is nearly finished, and it is intended to use this as an erecting shop, so that the works proper can be devoted entirely to constructional purposes. A separate saw-mills and wood-working plant is also to be erected, so that things look like being "some" busy.

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Last Saturday's "Show" at Hendon did not commence until rather late in the afternoon, when Lieut. Porte came out on the 100 h.p. "Dep." and put up some passenger flying, reminiscent of his racing in days gone by. R. M. Murray also got up and tried out a new British-built Caudron (35 h.p. Anzani), whilst W. F. Merriam tested a new Spencer biplane. This machine is like a miniature Henry Farman, and has a very business-like appearance. In addition to these flights there was plenty of school work going on with G.-W., Avro, L. and P., and Wright 'buses.

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Two old-timers visited Hendon from Farnborough this last week-end—R. J. Lillywhite and A. E. Barrs. The latter, looking quite different in his R.F.C. uniform and with a budding impenetrable forest on his upper lip, came to bid *adieu*, prior to departing for the front. They had lots of news to tell us, but for obvious reasons it is necessary to "censor" all the titbits. Lillywhite says he gets plenty to do flying and instructing, and the other day he "went" for his superior *brevet*, which, I believe, he obtained easily in a style which those who know him would anticipate. Lewis Turner, at Farnborough, by-the-way, is also busy turning out pilots.

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Although there is at present no megaphone man at Hendon to call out "Passenger flights may now be booked," these pleasaut and instructive episodes have

apparently by no means fallen off, for on Friday last three visitors each had a three-guinea flight on the British Caudron Co.'s 60 h.p. 'bus. This latter company, by-the-way, is quite busy just now turning out some new machines from their works at Old Hendon, about which more anon.

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Apropos of the avalanche of Iron Crosses falling upon the "Kultured Krowd" of the Kaiser, a few days ago when the subject cropped up incidentally during a lunch party, I heard a quiet remark dropped by one in association with the firm, suggesting that Messrs. Thos. Firth and Sons, if they could find time in their large rush of steel work, might not be averse to putting in a tender for a wholesale order—about a quarter of a million is spoken of—of these little marks of *distinction*—save the mark. From the high reputation of their well-known steels they would be able to guarantee (according to specification) high resistance to shock, a good temper, rustproofness and not to show German thumbmarks.

It has been suggested, by a colleague, that the crosses of this special material should be for those Germans who show the greatest effrontery; and that Dr. Albert Moll of the Psychology Society of Berlin should be awarded the first one delivered, for stating, according to Mr. F. W. Wile of the *Daily Mail*, that—

"Belgium has not been ravaged, pillaged, or sacked at all. It has merely been 'hypnotised' by the power of 'mass suggestion' into imagining its outrages. The girls and women who have been violated are miserable hypochondriacs. The men and boys who have told of countrysides laid bare and towns and cities fired are illiterate quidnuncs. And the members of the Commission of Inquiry themselves are demagogues and liars."

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It is always good news to know of any fresh development in the industry, and, therefore, I was pleased to hear recently that Mr. Holt Thomas had already commenced operations in connection with airships at the old works of the Aircraft Co. at Merton. A company has been formed under the name of "Airships, Ltd.," with Mr. T. Willows as chief engineer, and knowing that Mr. Holt Thomas seldom lets the grass grow under his feet, it should not be long before we see something doing in that direction. The company has acquired the right to build the Astra airships in this country, although none have yet been started.

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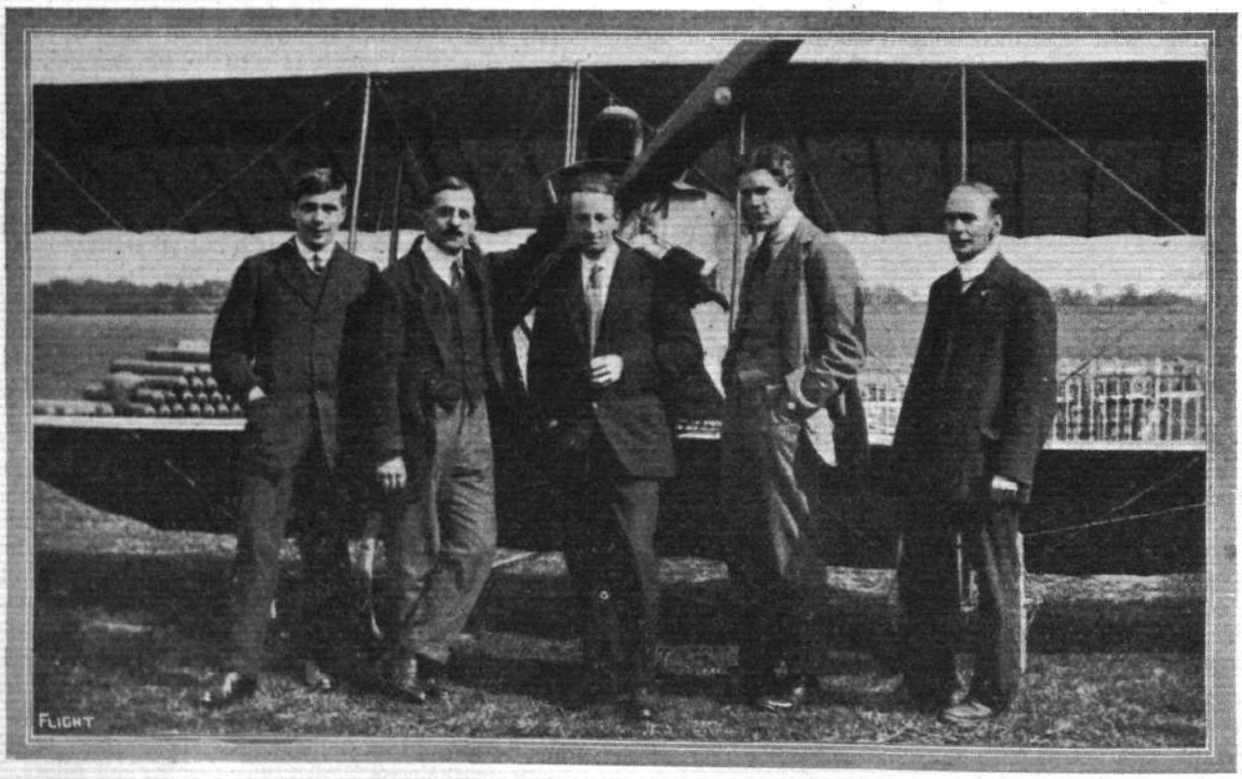
Recently I quoted from our American contemporary *Aeronautics* an interesting description of a species of aeroplane invented by one H. Van Wie. Hoping to learn further of the progress of aviation in the States, I looked through some other copies of this journal and found this:—"*Do Bodies Fall?* It is a commonly accepted fact that bodies gravitate towards the earth. Robert Stevenson" (*where have I heard that name before?*—Ed.) "of 604, West 115th Street, New York, tells the editorial department of this journal that all this theory of gravitation is pure bunk—that the earth falls toward the bodies. Mr. Stevenson states he is prepared to prove his own theory to the satisfaction of any open minded person, and would like to hear from those interested in discussing this." If this be so, in the future a description of an aeroplane flight would probably read something like this:—"The pilot took his seat in the biplane, and the mechanic having swung the propeller, he started off, the earth falling from the machine at a remarkable rate . . . . Suddenly his engine stopped and the earth immediately rose at an alarming velocity to meet the machine, coming into contact with the latter with some considerable force, doing much damage. The pilot was flung from his seat by the force of the impact, and the earth, *and* the damaged machine, bumped into him, breaking both his legs!"

"ÆOLUS."



"Flight" Copyright.

THE CONSTRUCTORS OF THE L. AND P. BIPLANE.—From left to right: G. W. Smiles, W. Warren, H. S. Gist (the man who built the *nacelle*), and M. J. Lindsay.

FROM THE BRITISH FLYING GROUNDS.

Royal Aero Club Eastchurch Flying Grounds.

Naval Flying.—Most of the flying during the week has been instructional. Machines out :—Bristol tractors, Blériot, Deperdussin, Maurice Farman and Shorts 1, 2, 62, 63, and 152, and Vickers' gun 'bus and B.Es. Bomb dropping was practised on Sunday on one of Shorts'.

Civilian Flying.—Mr. Alec Ogilvie made some very good flights on his 50 h.p. Wright.

Brighton-Shoreham Aerodrome.

Pashley Bros. and Hale School.—Instructors for week, E. and C. Pashley and F. Hale. Up with instructor, J. Cole, J. Sibley, J. Morrison, Menelas Babistis. Circuits and eights, C. Winchester and J. Woodhouse. Mr. Woodhouse, who should have taken his *brevet* this week, left for the front with the British Colonial Horse.

Eastbourne Aerodrome.

F. B. FOWLER and R. C. Hardstaff instructors during week with E.A.C. biplane. Sub-Lieuts. Huskisson, Nicholl, Petre, Iron, Wright, Dawson practising during week with instructor. Sub-Lieut. Petre circuits alone, he showing great promise.

London Aerodrome, Collindale Avenue, Hendon.

Grahame-White School.—Sunday, Sept. 27th, Sub-Lieut. Perry and Mr. Morgan solo straights. Sub-Lieut. Hart straights with Instructor Russell. Second Lieut. Polehampton and Sub-Lieut. Haines solo circuits, Lieut. Polehampton afterwards going in for and obtaining his certificate.

Monday, last week, very windy, pupils kept to hangars most of the day. Sub-Lieuts. Riggall and Rosher doing straights and circuits alone.

Tuesday, Messrs. Greenwood, Carabajal, and Sub-Lieuts. England and Giles straights with Instructors Manton, Shepherd and Russell. Mr. Easter solo straights. Sub-Lieut. Allen solo circuits, and Sub-Lieut. Strong circuits and 8's.

Wednesday, Sub-Lieuts. England, Giles, Hart, and Mr. Greenwood straights with Instructors Shepherd, Russell, Manton. Sub-Lieuts. Perry and Riggall and Mr. Carabajal solo straights. Sub-Lieuts. Allen, Haines, Perry, Rosher and Strong, and Messrs. Morgan and Mumby solo circuits, 8's, &c.; afterwards Sub-Lieuts. Haines and Rosher gaining their certificates.

Thursday, Sub-Lieut. Strong and Mr. Mumby *brevet* tests; gained certificate. Mr. Morgan circuits alone.

Friday, Sub-Lieuts. England, Giles, Hart, and Mr. Greenwood straights with Instructors Shepherd, Russell, Winter, and Manton. Sub-Lieut. Riggall and Messrs. Carabajal and Easter solo straights. Sub-Lieut. Riggall also solo circuits. Sub-Lieuts. Allen and Perry solo circuits, 8's, &c.

During the week 5 R.Ae. certificates have been secured.

Beatty School.—During last week the following pupils received instruction on dual-controlled biplanes :—Messrs. MacLachlan, Leong, Smith, Virgilio, Gardner, Aoyang, Parker, Whitehead, Jenkinson, Fletcher, Leeston-Smith, Beard, Beynon, Moore, Newberry, Bond, Monfea, Le Vey and Anstey Chave.

On Saturday morning Mr. C. H. C. Smith flew for his certificate, which he obtained in very good style, reaching nearly 2,000 ft. in his altitude test.

British Caudron School.—Monday last week too windy for school work.

Tuesday, school out at 6 a.m. Trial flights by instructors. Pupils doing straights, Messrs. Christie, Ivermee and Moon; Mr. Barfield rolling. Mr. Abbott doing straights under the instruction of E. Prosser on 45 h.p. Caudron biplane. Evening: Messrs. Legh, Christie, Moon and Ivermee straights. Messrs. Barfield, Gunner and Stevens rolling practice.

Wednesday morning misty. School at 7 o'clock, under the instruction of R. Desoutter, R. M. Murray and E. Prosser. Messrs. R. Desoutter and R. M. Murray test flights. Mr. Abbott doing figures of eight on 45 h.p. under the instruction of E. Prosser. Mr. Abbott ready for his brevet. Mr. Legh also on 45 h.p. Messrs. Ivermee, Christie and Moon doing straights. Messrs. Stevens, Gunner and Barfield rolling.

Thursday evening, new 35 h.p. school 'bus tried. Mr. Abbott figures of eight on 45 h.p.

Friday morning, R. Desoutter test flight, followed by Messrs. Moon, Christie, Ivermee and Barfield, doing straights on new 35 h.p. machine, all making very good progress. Mr. Abbott doing figures of eight under the instruction of E. Prosser. Evening, school out at 4.30 p.m. Messrs. Christie, Moon, Barfield and Ivermee doing straights. Messrs. Abbott and Legh under the instruction of E. Prosser on 45 h.p. Mr. Abbott successfully passed for the first two tests of his *brevet*. Passenger flights by R. Desoutter on 60 h.p.

Saturday, too windy for morning work. School out in the evening. Messrs. Christie and Invermee straights. Messrs. Barfield, Gunner and Stevens rolling.

Sunday morning, R. M. Murray test flight. Messrs. Christie and Moon straights.

Hall School.—Tuesday last week, very windy in morning. In the evening, J. L. Hall instructing, E. Brynildsen six straight flights.

Wednesday, in the morning dense fog. In evening, E. Brynildsen seven straight flights.

Thursday, in morning, E. Brynildsen six straight flights, landing very neatly. In evening, E. Brynildsen seven straight flights and one half circuit.

Friday, in morning no pupils turn up. In evening, E. Brynildsen six straight flights and two half circuits.

Instructor of the week, J. L. Hall. New Hall tractor biplane now completed. Will be tested shortly by J. L. Hall.

Mr. C. M. Crowe, who secured his certificate at the Grahame-White School, Hendon, on September 7th.

THE STABILITY OF AEROPLANES.*

THE VARIOUS INTRICATE PROBLEMS OF BALANCE.

By ORVILLE WRIGHT, B.S., LL.D.

A FLYING machine must be balanced in three directions: about an axis fore and aft in its line of motion, about an axis extending in a lateral direction from tip to tip of the wings, and about a vertical axis. The balance about the lateral axis is referred to as fore-and-aft or longitudinal equilibrium; that about the fore-and-aft axis as lateral equilibrium, and that about the vertical axis is generally referred to as steering, although its most important function is that of lateral equilibrium.

If the centre of support of an aeroplane surface would remain fixed at one point, as is practically the case in marine vessels and in balloons and airships, equilibrium would be a simple matter. But the location of the centre of pressure on an aeroplane surface changes with every change in the angle at which the air strikes the surface. At an angle of 90 degrees it is located approximately at the centre of the surface. As the angle becomes less, the centre of pressure moves forward. On plane surfaces it continues to move forward as the angle decreases until it finally reaches the front edge. But on cambered surfaces the movement is not continuous. After a certain critical angle of incidence is reached, which angle depends upon the particular form of the surface, the centre of pressure moves backward with further decrease in angle until it arrives very close to the rear edge. At angles ordinarily used in flying, angles of 3 degrees to 12 degrees, the travel of the centre of pressure is in this retrograde movement and is located, according to the angle of incidence, at points between 30 per cent. and 50 per cent. back of the front edge of the surface. The location of the centre of pressure on any given surface is definitely fixed by the angle of incidence at which the surface is exposed to the air.

The placing of the centre of gravity of the machine below its centre of support appears, at first glance, to be a solution of the problem of equilibrium. This is the method used in maintaining equilibrium in marine vessels and in balloons and airships, but in flying machines it has the opposite of the desired effect. If a flying machine consisting of a supporting surface, without elevator or other means of balancing, were descending vertically as a parachute, the centre of gravity vertically beneath the centre of support would maintain its equilibrium. But as soon as the machine begins to move forward the centre of pressure, instead of remaining at the centre of the surfaces, as was the case when descending vertically, moves toward that edge of the surface which is in advance. The centre of gravity being located at the centre of the surface and the centre of pressure in advance of the centre of the surface, a turning moment is created which tends to lift the front of the machine, thus exposing the surfaces at a larger angle of incidence and at the same time to a greater resistance to forward movement. The momentum of the machine, acting through its centre of gravity below the centre of forward resistance, combines with the forward centre of pressure in causing the surface to be rotated about its lateral axis. The machine will take an upward course until it finally comes to a standstill. The rear edge of the surface will now be below that of the front edge, and the machine will begin to slide backward. The centre of pressure immediately reverses and travels toward the rear edge of the surface, which now in the backward movement has become the front edge. The centre of gravity again being back of the centre of pressure, the advancing edge of the surface will be lifted as before, and the pendulum effect of the low weight will be repeated. A flying machine with a low centre of gravity, without rudders or other means to maintain its equilibrium, will oscillate back and forth in this manner until it finally falls to the ground.

It will have been observed from the foregoing that the equilibrium in the horizontal plane was disturbed by two turning moments acting about the lateral horizontal axis of the machine; one produced by the force of gravity and the lift of the surface acting in different vertical lines, and the other by the centre of momentum and the centre of resistance acting in different horizontal lines.

It is evident that a low centre of gravity is a disturbing instead of a correcting agent. The ideal form of flying machine would be one in which the centre of gravity lies in the line of the centre of resistance to forward movement and in the line of thrust. In practice this is not always feasible. Flying machines must be built to land safely as well as to fly. A high centre of gravity tends to cause a machine to roll over in landing. A compromise is therefore adopted. The centre of gravity is kept high enough to be but a slight disturbing factor in flight and at the same time not so high as to interfere in making safe landings.

* Abstract of a paper presented at a stated meeting of the Franklin Institute held on Wednesday, May 20th, 1914, when Dr. Wright received the Institute's Elliott Cresson Medal in recognition of the epoch-making work accomplished by him in establishing on a practical basis the science and art of aviation.

The three forces acting on an aeroplane in the direction of its line of motion are the thrust of the propellers, the momentum or inertia of its weight, and the resistance of the machine to forward travel. If traveling in any other than a horizontal course, a component of gravity in the line of motion will have to be reckoned with. When these forces are exerted in the same line, with the centres of thrust and momentum acting in the opposite direction to that of the centre of resistance, a variation in the quantity of any one, or of all, of these forces will not in itself have a disturbing effect on the equilibrium about the lateral horizontal axis. But these forces in the ordinary flying machine do not act in the same line. Usually the centre of thrust is high in order to give proper clearance between the propellers and the ground; the centre of gravity is low to enable the machine to land without danger of being overturned; and the centre of resistance is usually between the centres of thrust and gravity. When a flying machine is travelling at uniform speed the propelling forces exactly equal the resisting forces. In case the thrust of the propellers is diminished by throttling the motor, the momentum of the machine acting below the centre of resistance carries the lower part of the machine along faster than the upper part, and the surfaces thus will be turned upward, producing a greater angle and a greater resistance. The same effect is produced if the machine be suddenly struck by a gust of wind of higher velocity from in front. The thrust of its propellers will be temporarily slightly decreased, the resistance due to the greater wind pressure will be increased, and the momentum of the machine (the centre of gravity being low) will in this case also turn the surfaces upward to a larger angle. While these variations in the forces acting in the horizontal line have of themselves a certain amount of disturbing effect, yet it is from the changes of incidence which they introduce that one encounters the greatest difficulty in maintaining equilibrium.

The two principal methods used in preserving fore-and-aft equilibrium have been, first, the shifting of weight so as to keep the centre of gravity in line with the changing centre of lift; and, second, the utilisation of auxiliary surfaces, known as elevators, to preserve the position of the centre of pressure in line with a fixed centre of gravity. The first method has been found impracticable on account of the impossibility of shifting large weights quickly enough. The second method is that used in most of the flying machines of to-day.

Flying machines of this latter type should have their auxiliary surfaces located as far as possible from the main bearing planes, because the greater the distance the greater is the leverage and consequently the smaller the amount of surface required. The auxiliary surfaces are usually placed either in front or in the rear of the main supporting surfaces, since they act with greater efficiency in these positions than when placed above or below.

With a view to high efficiency, no part of either the main surfaces or the auxiliary surfaces should be exposed on their upper sides in a way to create downward pressures. One pound of air pressure exerted downward costs as much in propelling power as two pounds of downward pressure produced by actual weight carried. This is due to the fact that the total pressure on an aeroplane is not vertical, but approximately normal to the plane of the surface. This pressure may be resolved into two forces, one acting in a line parallel with the direction of travel, and the other at right angles to the line of travel. One is termed "lift" and the other "drift." With a given aeroplane surface, the drift and lift for any given angle of incidence always bear a definite ratio to one another. This ratio varies from 1 to 12 to 1 to 1, according to the angle of incidence and the shape of the surface. On an average it is about 1 to 6, so that the thrust required of the propeller in the ordinary flying machine is approximately one-sixth of the weight carried. When travelling on a horizontal course the lift is vertical and is exactly equal to the total weight of the machine and load. This load may be real weight, or it may be partly real weight and partly downward pressures exerted on parts of the surfaces. For every pound of weight carried, a thrust of approximately one-sixth pound is required. If however, instead of real weight a downward air pressure is exerted on some part of the machine, this downward pressure must be overcome by an equal upward pressure on some other part of the machine, to prevent the machine from descending. In this case the horizontal component of the one pound downward pressure will be about one-sixth pound, and the horizontal component of the compensating upward pressure also will be about one-sixth pound, making a total of one-third pound required in thrust from the propellers, as compared with one-sixth pound thrust required by one pound actual weight carried. It is, therefore, evident that the use of downward air pressures in

maintaining equilibrium is exceedingly wasteful, and, as far as possible, should be avoided. In other words, when the equilibrium of an aeroplane has been disturbed, instead of using a downward air pressure to depress the elevated side an upward pressure should be ultized to elevate the low side. The cost in power is twice as great in one case as in the other.

The dynamically less efficient system of downward air pressures is used to some extent, however, on account of its adaptability in producing more or less inherently stable aeroplanes. An inherently stable aeroplane may be described as one in which equilibrium is maintained by an arrangement of surfaces, so that when a current of air strikes one part of the machine, creating a pressure that would tend to disturb the equilibrium, the same current striking another part creates a balancing pressure in the opposite direction. This compensating or correcting pressure is secured without the mechanical movement of any part of the machine.

The first to propose the use of this system for the fore-and-aft control of aeroplanes was Penaud, a young French student, who did much experimenting with model aeroplanes in the 70's of the last century. His system is used only to a slight extent in the motor-driven aeroplanes of to-day, on account of its wastefulness of power and on account of its restriction of the manœuvring qualities of the machine.

Penaud's system consists of a main bearing surface and a horizontal auxiliary surface in the rear fixed at a negative angle in relation to the main surface. The centre of gravity is placed in front of the centre of the main surface. This produces a tendency to incline the machine downward in front, and to cause it to descend. In descending the aeroplane gains speed. The fixed surface in the rear, set at a negative angle, receives an increased pressure on its upper side as the speed increases. This downward pressure causes the rear of the machine to be depressed till the machine takes an upward course. The speed is lost in the upward course, the downward pressure on the tail is relieved, and the forward centre of gravity turns the course again downward. While the inherently stable system will control a machine to some extent, it depends so much on variation in course and speed as to render it inadequate to meet fully the demands of a practical flying machine.

In order to secure greater dynamic efficiency and greater manœuvring ability, auxiliary surfaces mechanically operable are used in present flying machines instead of the practically fixed surfaces of the inherently stable type. These machines possess the means of quickly recovering balance without changing the direction of travel and of manœuvring with greater dexterity when required. On the other hand, they depend to a greater extent upon the skill of the operator in keeping the equilibrium. It may be taken as a rule that the greater the dynamic efficiency of the machine and the greater its possibilities in manœuvring, the greater the knowledge and skill required of the operator.

If the operator of a flying machine were able to "feel" exactly the angle at which his aeroplane meets the air, 90 per cent. at least of all aeroplane accidents would be eliminated. It has been the lack of this ability that has resulted in so large a toll of human lives. Instruments have been produced which indicate closely the angle of incidence at which the machine is flying, but they are not in general use. Nor does the average flyer realize how exceedingly dangerous it is to be ignorant of this angle. Most of the flyers are aware that "stalling" is dangerous, but do not know when they really are "stalling."

A flying machine is in great danger when it is flying at its angle of maximum lift. A change either to a smaller or a larger angle results in a lesser lift. There is this important difference however, whether the angle be increased or decreased. While a smaller angle gives less lift, it also has less drift resistance, so that the machine is permitted to gain speed. On the other hand, the larger angle gives not only less lift but encounters a greater resistance, which causes the speed of the machine to be rapidly checked, so that there is a double loss of lift—that due to angle and that due to a lesser speed.

The maximum lift is obtained in most flying machines at some angle between 15° and 20°. If the machine be gliding from a height with the power of the motor throttled or entirely turned off, and the operator attempt to turn it to a level course, the speed of the machine will soon be reduced to the lowest at which it can support its load. If now this level course be held for even only a second or two, the speed and the lift will be so diminished that the machine will begin to fall rapidly.

The centre of pressure on a cambered aeroplane surface at angles greater than 12° to 15° travels backward with increase of angle of incidence, so that when a machine approaches the "stalled" angles the main bearing surfaces are generally carrying practically all of the weight and the elevator practically none at all. Under these conditions the main surfaces fall more rapidly than does the rear elevator. The machine noses downward and plunges at an exceedingly steep angle toward the earth. This plunge would tend to bring the machine back to normal speed quickly were the machine flying at its usual angle of incidence. But at the large angles of incidence the drift is a large part of the total pressure on the surfaces, so that, although plunging steeply downward, speed is recovered but slowly. The more the operator tries to check the downward plunge by turning the elevator, the greater becomes the angle of incidence, and the greater the forward resistance. At ordinary stalled angles the machine must descend at an angle of about 25° with reference to the horizontal in order to maintain its speed. If the speed be already below that necessary for support, a steeper angle of descent will be required, and considerable time may be consumed before supporting speed can be recovered. During all this time the machine is plunging downward. If the plunge begins at a height of less than two or three hundred feet, the machine is likely to strike the ground before the speed necessary to recover control is acquired.

The danger from "stalling" comes in the operator attempting to check the machine's downward plunge by turning the main bearing surfaces to still larger angles of incidence instead of pointing the machine downward, at a smaller angle of incidence, so that the speed can be recovered more quickly. It is safe to say that fully 90 per cent. of the fatal accidents in flying are due to this cause. Most of the serious ones occur when, after long glides from considerable heights, with the power of the motor reduced, an attempt is made to bring the machine to a more level course several hundred feet in the air. The machine quickly loses its speed and becomes "stalled." All of us who have seen the novice make a "pancake" landing have seen the beginning of a case of "stalling" which might have been fatal had it taken place at a height of one or two hundred feet.

The greatest danger in flying comes from misjudging the angle of incidence. If a uniform angle of incidence were maintained, there would be no difficulty in fore-and-aft equilibrium. As has already been stated, for any given surface and any given angle of incidence the position of the centre of pressure is fixed. Under these conditions, if the centre of gravity were located to coincide with the centre of pressure, and a uniform angle of incidence maintained, the machine would always be in equilibrium.

It is in accordance with this principle that experiments the past year have brought about a considerable advance in the development of automatic stability. A small horizontal wind vane is so mounted on the machine as to ride edgewise to the wind when the machine is flying at the desired angle of incidence. In case the machine varies from the desired angle, the air will strike the vane on either its upper or lower side. The slightest movement of the vane in either direction, brings into action a powerful mechanism for operating the controlling surfaces.

If the wind strikes the vane on the under side, as would be the case when the machine takes a larger angle of incidence, the elevator is turned to cause the machine to point downward in front till the normal angle is restored. If the air strike the vane from above, a smaller angle of incidence is indicated, and an opposite action on the elevator is produced. In this system no particular angle of the machine with the horizontal is maintained. It is the angle at which the air strikes the aeroplane surface that is important. If the vane is set at an angle of 5° with the main supporting surfaces, and the machine is travelling on a level course, increasing the power of the motor will cause it to begin taking on more speed. But as the lifting effect of an aeroplane surface is the product of two factors—its speed and its angle of incidence—any increase in speed will produce a greater lift and cause the machine to rise. The machine will now be turned upward, with the surfaces meeting the air at an angle of 5°. On the contrary, if the power of the motor be reduced or entirely turned off, the machine will immediately begin to decrease in speed, requiring a larger angle of incidence for support. But as soon as the angle begins to increase the air will strike the regulating vane on the underside and the elevator will be turned, pointing the machine downward till the component of gravity in the direction of travel becomes sufficient to maintain the normal speed. In this case the planes will be inclined downward with reference to the horizontal. It is evident that a machine controlled by regulating the angle of the machine with reference to the impinging air is not liable to the dangers of "stalling" already described.

Several other methods of maintaining fore-and-aft equilibrium automatically have been proposed. One utilizes the force of gravity acting on a pendulum or a tube of mercury; the other the gyroscopic force of a rapidly revolving wheel. In both of these systems the angle of the machine is regulated with reference to the horizontal, or some other determined plane, instead of with the angle of the impinging air.

In the case just referred to, in which the power of the motor was suddenly turned off while travelling on a level course, with these systems, the planes would be maintained at their original angle with

the horizontal without any regard to the angle of incidence. The machine would continue forward till, through the loss of momentum, its speed would become so reduced and its angle of incidence so great that it would be exposed to the dangers of diving.

The pendulum and mercury tubes have other serious faults which render them useless for regulating fore-and-aft equilibrium. If the machine suddenly meet with a greater resistance to forward travel, either as a result of change in direction or of meeting a stronger gust of wind from in front, and its speed be ever so slightly checked, the pendulum will swing forward, and instead of turning the machine downward, so as to maintain the normal speed, will cause the machine to be inclined upward in front and thus further increase its forward resistance.

The pendulum has proved itself an exceedingly useful device, however, in regulating the lateral stability of aeroplanes. In this case the effects of momentum and centrifugal force act on the pendulum in the proper direction to produce desired results.

I believe the day is near at hand when the flyer will be almost entirely relieved of the work of maintaining the equilibrium of his machine, and that his attention will be required only to keeping it on its proper course and in bringing it safely in contact with the ground when landing.

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AIRCRAFT AND THE WAR.

WRITING on Saturday week in the *Daily Telegraph* regarding the re-shuffling of the German troops which had taken place during the week, Mr. W. T. Massy said :—

"Acting on the principle that the longest way round is the shortest journey, they took the troops fully 100 miles by rail by a semi-circular route, hoping thereby to escape the vigilance of the flying sections, which have become the eyes of armies. If they anticipated that they could move several army corps without the aviators catching sight of them, they have been woefully disappointed. The movement was noted before it began.

"The part the aviator is playing in this war will receive its due praise from the historian. The generals of the Allied Forces have already commented on the energy, enterprise, daring, and soldierly qualities of the flying men, and to-day they must congratulate themselves upon the support the aerial scouts have given in the latest phase of the campaign. Reconnaissance work by flying squadrons disclosed the fact that a vast quantity of railway stock was being concentrated in the eastern theatre of war. It was not all on the lines close to the positions held by the enemy. That would have meant congestion, and no aviator would assume that crowded railway tracks would mean a speedy entrainment for another portion of the battle-line. But the fact that every siding for thirty or forty miles held an empty military train suggested that an important new movement was about to be started.

"Various reports from the aerial scouts had to be compared before the real motive of the enemy could be discovered. Did it mean that the Germans intended to evacuate the whole line? That idea was dispelled by the absence of any report by the British and French aviators on the west that large quantities of railway material were being assembled in the regions they watch so closely. East, centre, and west would have to begin together a general retirement, and if one commenced an operation without any reply from the other it was obvious that retirement was not the object."

In a message describing the shelling of Albert on the 29th ult., a correspondent of the *Daily Mail* writes thus of the work of the German aeroplanes :—

"There were French batteries at various points round Albert, but none within a mile of the town. At four o'clock yesterday afternoon a Taube monoplane made a reconnaissance some 7,000 ft. above them.

"'Ah,' said one of the gunner officers at the battery on the Péronne road, 'there is that wretched bird which haunts us. In an hour or less we shall begin to be aware of the report it has given.'

"He was curiously accurate in his prediction. At ten minutes past five German shells from heavy guns began to fall."

Italy has utilized her airships in connection with mine-sweeping operations in the Adriatic and it is said that when the airship was cruising at a height of 250 feet it detected several mines.

In Japan both sides have been making extensive use of aeroplanes; a message from Tokio on the 30th ult. stated that the pilots of two Japanese biplanes and of one monoplane report that they have dropped bombs on German vessels from a height of about 2,300 ft. Although the wings of the machines were riddled with bullets, all returned safely.

In the attack on the Japanese positions at Tsingtao on the following day it was reported that the German warships were assisted by aeroplanes. Japanese waterplanes reported that considerable damage had been done to Tsingtao by the bombardment.

On the 1st inst. a Zeppelin airship was reported the previous night successively over Moll, Rethy, Turnhout, Bourz-Leopold, Merxplas, Brecht, Poostmalle and Westmalle, and at 3.30 the next morning dropped bombs near Fort Broechem, but inflicted no serious damage. It then approached Antwerp, but was put to flight by the forts.

Writing from Antwerp on September 30th, a correspondent of the *Morning Post*, regarding the attack on the city, said :—

"Our aviators, who have made in all ten reconnaissances, have also found no indications of great masses of infantry. In aerial reconnaissances one very plucky Belgian feat is to be recorded. The aviator, flying very low over the German position, was heavily bombarded with shrapnel. He retreated, rose to a greater height, and then returned to his reconnaissance."

Information to hand from Dutch sources states that one of the German 11-in. howitzers was located by a Belgian airman, and put out of action by concentrated fire from the Belgian lines.

On the same day at the shelling of Termonde the work of the Belgian aviators resulted in the silencing of some of the German guns, according to a *Daily Telegraph* correspondent.

"Their (the Belgian gunners') success was probably due to a clever aeroplane reconnaissance which I witnessed. One of the machines flew over the enemy's positions. As it returned it was fired on by the Germans with shrapnel. I saw two shells burst below it. The aeroplane, however, was flying very high, and, untouched, it disappeared behind the Belgian lines."

The difference in the effect of the appearance of a German aeroplane, upon the civil population and soldiers who have been in the firing line is thus graphically put by an officer in the Army Service Corps :—

"While I was at the station a German aeroplane came over; there was something terrifying about it, it was so aggressive-looking, black, and hawk-like. Instantly panic prevailed among the people, women fainted, screamed, and rushed here and there. Railway officials blazed away with rifles, which only added to the confusion. Several English wounded were there absolutely unmoved and smiling indulgently at the excitability of the male portion of the panickers. The invader had short shrift, for soon, like a bird, one of our aeroplanes shot up in pursuit, followed swiftly by two others. Up they went, circling and manœuvring until one got above the German, forcing him down until a shot brought him down with a rush—dead."

Another message from the *Morning Post* correspondent, dated Antwerp, October 2nd, giving a thrilling picture of the perilous work of the aviator on active service :—

"A little after four a biplane rose out of Antwerp and headed for the German lines between Willebroek and Heyndonck. These machines fly with almost incredible swiftness. This one passed a fast motor car going in the same direction as easily as a swallow passes a sparrow.

"As soon as the aeroplane got over the German lines, where its object was apparently reconnaissance, it came under fire of the German guns specially designed to attack aviators. Two of these guns engaged the aviator. They fired first ranging shells, which, on bursting, left a thick ball of black smoke. These shells, apparently fired with a difference in elevation of 500 feet, were designed to ascertain the elevation of the aeroplane, but the aeroplane seemed to shape its course so as to avoid passing near the smoke balls, which were in any case at a greater height than itself.

"The German guns then began with shrapnel fire as if satisfied

with the information given by their ranging shells. Twelve shells were fired, all at a greater height than the aeroplane, as if the design were to scatter balls on it from above. Changing its course occasionally the aeroplane flew about, completed its work, and winged its way back to the Belgian lines. Its passage in safety under bursting shrapnel was one of the most exciting warfare incidents imaginable."

A correspondent of the *Daily Call* sent the following from Amsterdam on the 4th inst. :—

"Information has been received here from Berlin that the Kaiser has promised to confer a special decoration of the second class of the Order of the Red Eagle on the first German aviator who succeeds in dropping explosives on London.

"Other lesser, but still unusual, honours are promised to German aviators who succeed in dropping explosives either on a British warship or on some other town in England."

In a message from Deal to the *Daily Chronicle* the following information was given regarding the adventures of Lieut. Rainey, who belongs to the Royal Naval Air Service, who arrived from France in a battle-scarred machine :—

"Lieutenant Rainey has been engaged for the past three weeks in reconnoitring at the front, and so little leisure has he been able to snatch that, as he told his friends here, during the whole of that time he could not remove his clothes, or even secure a wash.

"He had two machines disabled by rifle and shell fire, whilst a third caught fire in mid-air. On each of these occasions he very narrowly escaped fatal disaster.

"His flights lasted for many hours together, and on one occasion he was in the air for 24 hours at a stretch.

"Once when he came down he was so exhausted that he lay with his head on his aeroplane and fell fast asleep. On waking he was surprised to find that the puttee, boot and sock of one leg had been removed by someone who, as the lieutenant himself suggested, took the opportunity of his slumber to secure them as mementoes.

"Lieut. Rainey brought home with him a German helmet belonging to a man he shot, and he proudly claimed that it was the first trophy of the kind taken by a British airman.

"After securing a new machine Lieut. Rainey is returning to the front."

An official report issued in Tokio on Saturday stated :—

"A German aeroplane at Tsingtao twice attempted to attack the Japanese vessels, but without result. A Japanese aeroplane, pursuing it, attacked with bombs a captive balloon just being hauled back to Tsingtao, it is not known with what damage."

The following *resumé* of an interesting article in the *Bourse Gazette* describing the capture of the Zeppelin Z 5 by the Russians, was wired from Petrograd by the correspondent of the *Daily Telegraph* on Saturday :—

"Our cavalry brigade, with a horse battery, was proceeding in marching order from the village of ——, near Soldau, in the direction of the suburb of ——. As the brigade was approaching the frontier cordon a German airship was seen steering straight for us from the direction of Mlava. As the commander of the battery was at that moment with the chief of the division at the tail of the column fire was at once opened at this enticing target, but the shots appeared to fall short. The range was increased, and at the third volley the airship began to assume a vertical inclination. This, as was shown later, was due to the breaking of the stabilisator and rudder by our fire. However, the airship continued on its course towards the German frontier, though travelling slowly, and disappeared behind a wood to the left of the battery.

"Without losing a moment the guns were taken round the wood at the gallop, and renewed their fire. While they were on their way the airship flung down bombs at them, but without any success. It then directed a machine gun upon them, but the bullets fell short, and did no damage.

"From the new position only one volley was fired, as the dirigible now stopped for a moment, and then was carried back by the wind towards the south. Quickly the battery galloped back to its first position, whence the airship was finally disabled, and compelled to descend within three miles of the village of Lipovitz. Several cavalry men, with the senior officer of the battery, were sent to receive the prize, but when they reached the airship they found they had been anticipated by a Cossack patrol, which seemed to have sprung out of the ground. The prisoners taken were the commander of the Zeppelin, Captain of Airship Battalion Gruener, Lieut. Wilhelm Rehling, the mechanic, and four soldiers. One officer and two lower grades somehow had time to hide in the neighbouring village, but were discovered on the following day. Thus the whole crew of ten were captured. Lieut. Rehling had torn off his officer's epaulets in order to conceal his rank. Only one officer and soldier were wounded, but the apparatus had been badly damaged in the air. The rudder, propellers, benzine tubes, motors, and stabilisator had all suffered, and the hull had been pierced in several places.

"According to the admissions of Captain Gruener, the airship was vitally injured by our first discharge, but its dirigibility was completely destroyed by the fire from the second position. When our artillery commander asked, 'How could you dare to steer so impudently direct for our battery?' Gruener replied that he had more than once been under cannon fire, and had always come out successfully.

"The hull was eventually blown up by our cavalry, but a large number of trophies were carried off. They included an army flag, with the name 'Zeppelin 5' and the embroidered Prussian eagle insignia of the order 'Pour la Mérite,' two machine guns, a machine rifle, four motors, many plans, maps, sketches, documents, photographic apparatus, and forty signal rockets. All the bombs had already been used. Some of them had been thrown on to Mlava Station, where several of our soldiers were killed by them."

In this connection the *Morning Post* correspondent at Petrograd on Monday wrote :—

"A German Zeppelin, or rather its remains, has been brought to Petrograd and carefully examined by experts. This is one of Germany's huge airships, brought down by fire from the Russian batteries in the neighbourhood of Warsaw. Russian aviators, although little has been allowed to be known of them, have been doing admirable work on all the fronts since the beginning of the war. I heard an interesting account of one of the most distinguished of Russia's aviators, who early in the war flew over and beyond Königsberg, where he was compelled to come down by something going wrong with the engine. He landed in a German village, and was immediately surrounded by alarmed peasants, to whom he explained in German that the Cossacks were coming, and he had flown ahead to warn the country. A general panic ensued, but a few valiant yokels were persuaded to remain and assist the gallant aviator to put things right and then start his engine. He returned to his own lines all right, with some highly valuable observations."

Writing on Monday, a correspondent of the *Daily Mail* thus describes how some French gunners deceived German aviators :—

"So quiet have things been that some of the French troops, for want of anything better to do, have been playing tricks on the enemy. Some artillery drivers with the help of a handful of sappers said to themselves one day : 'It is a pity these German aeroplanes should not have something to report. Let us give them something.'

"So they got a tree-trunk, hollowed it out a little, fixed it up on a cart as if it were a gun, with other trunks near it ; then put some straw in the hollow, and, when a "Taube" came over, grouped themselves as if they were artillerymen firing, and lit the straw with a little powder, which made a fine flash and puff.

"Immediately the "Taube" let off a smoke bomb to give the German gunners the range, and soon a bombardment of the tree-trunk began, the drivers and sappers having meanwhile got well into shelter, where they looked at the waste of royal and imperial ammunition with great joy ! They declare they played this trick three times."

Mr. G. H. Perris telegraphing to the *Daily Chronicle* on Monday records a piece of useful work accomplished as the result of an aeroplane reconnaissance :—

"At one point to which German reinforcements were being brought a column of —— Lancers (name cut out by Censor) intervened effectually.

"An aviator had brought news that while two reconstituted divisions of infantry of the Prussian Guard were advancing by road, with cavalry and the usual accompaniments, their heavy artillery was being brought up by railway.

"The Lancers spent a watchful night in ambush beside the line, and at 4 o'clock in the morning successfully blew up the train with a mine they had prepared.

A *New York World* cable reported on Monday :—

"The Russian main army is now in complete readiness to strike a blow at the enemy which is coming within its grasp. Russian aeroplanes yesterday morning flew over the German positions, and though they encountered German aeroplanes and were frequently fired at from the land and in the air they returned safely to their own lines with full reports of the enemy's positions."

Models

Edited by V. E. JOHNSON, M.A.

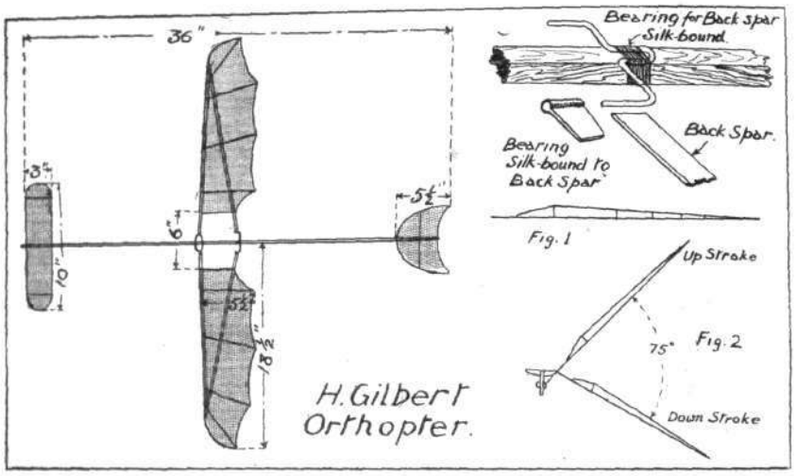
Mr. H. Gilbert's Model Orthopter.

"I CONSIDER," writes our correspondent, "the problem of the orthopter a fascinating one, and it is certainly a pity that model aeroplane makers do not tackle the problem with more zest than appears to have been the case. This model orthopter is the first I have built, and is the result of observations of sea-gulls and rooks. It will be seen that it has a fairly large span and wing area, and is consequently a rather slow 'flapper.' The wings are built up in rather a novel way, and by this method an unusual amount of flexibility is obtained where it is needed most. The angle of incidence near the body is rather large, and it gradually decreases to a wash out at the tips, which possess a negative angle of incidence. A good idea of the wing formation is obtained by looking at the photo., which shows the spars and ribs very clearly. The reason for this flexibility is that it acts as a propeller blade when it is flexed by the air-pressure while flapping. Indeed, quite a considerable draught is noticeable at the back of the planes while they are flapping, which serves to show that they must propel. The model is constructed in the usual manner, and I consider that the reason for its flying at its first attempt is that nothing freakish is incorporated in its design and no attempt was made to build any fancy and useless parts. The adjustment of the wings and motor was just right, and its gliding angle was quite correct when assembled. The disposition of weights had to be carefully considered, as when they are once fixed they cannot be moved without spoiling the whole model. The very small tail will be noticed, and this was decided on because all birds seem to seldom use their tails except for alighting purposes. The gull is an example. The reason for providing a rather large elevator was that it is designed to carry an appreciable amount of weight and to effect slight adjustments for the gliding angle. The clockwork—[? —V.E.J.]—motor is of the same type that was illustrated some time ago in FLIGHT, so there is no need to describe it. As regards the flying of the model, it was very interesting and provided food for much thought. It rises at rather a steep angle while the full power is on, and as the power gradually gets less it proceeds in a rather jerky manner. The following illustration describes it.

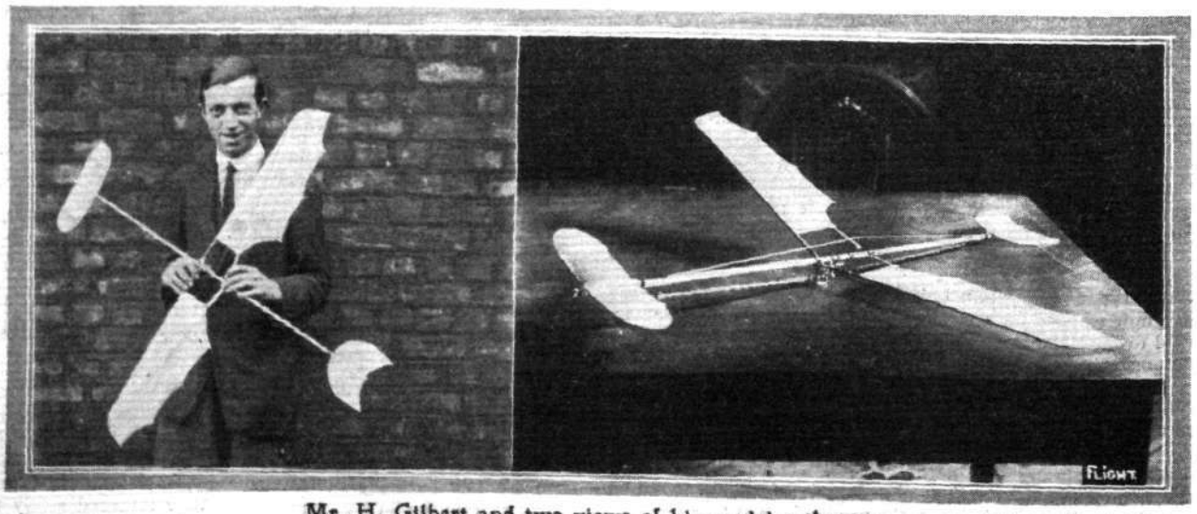
"This is no doubt due to the up-and-down motion of the wings. As the wing is on the down (impulse) stroke it shoots upwards, and as it is on the upward stroke (which is slower than the down stroke owing to the rubber which provides the impulse being against it), it glides down till the impulse stroke sends it up again, and so on. The best flight up to date is 12 seconds, which, to the average duration exponent, may seem very small, but as the motor is a geared DOWN one, and the length of the rubber motor is rather small (the length of the rubber motors is 12 ins. each), it will be seen how the duration is curtailed. In my opinion a direct-driven motor would be impossible, as it would have to have an enormous amount of rubber, and the frame would consequently have to be of abnormal weight to withstand the strain. This applies chiefly to large span models, although for small span models it may be feasible. I have found it practically impossible to get a flight unless I provide a greater impulse to the down stroke than to the upward one. The rubber for these impulses is not shown on the photo., as it was more convenient to photograph without it on. The angle of the wings from the bottom of the down stroke to the top of the upward stroke is 75°.

"The following measurements and description of model may be of interest:—

"The span of the wings from tip to tip is 38 ins.; the front spar is $\frac{5}{16}$ in. at the beginning, and tapers to $\frac{1}{8}$ in. at the tips; the space between the wings is 6 ins.; the back spar is $\frac{1}{4}$ in. by $\frac{1}{8}$ in., the same all the way; the average chord is $5\frac{1}{2}$ ins.; the wings slope slightly backwards; the ribs are of yellow bamboo; the curved tip is of bamboo; the elevator has a span of 10 ins., a chord of 3 ins., and is also made from bamboo; the tail is a semi-circle, with a diameter of $5\frac{1}{2}$ ins., and is very flexible; this is also made of bamboo; the weight of the complete model is $3\frac{3}{4}$ ozs.; the rubber motors consist of 9 strands of $\frac{1}{16}$-in. square rubber each; all joints are bound with silk steeped in glue; the main planes, elevator, and tail are covered with Clarke's flight silk, which makes a splendid



Mr. H. Gilbert's orthopter to scale, with some detailed parts.



Mr. H. Gilbert and two views of his model orthopter. *Photo. by Mr. A. Fineberg.*

light covering; the motor rod is a ¼-in. square piece of maple, and is 3 ins. long, and is stayed up in the usual manner with a king post in the centre. The centre of gravity of the machine is situated just behind the front spars."

Our correspondent, who invites criticism on the above, informs us that he intends to experiment a great deal with this type of model—a fact which we note with much pleasure.

Messrs. J. Bonn and Co.'s New Disc Wheels.

We have received from the above well-known firm a pair of their new disc wheels, for model aeroplanes, &c., with the request that we put them to any test we like, for the purpose that is for which they are intended; the makers being quite sure that they will emerge triumphant. They are certainly in every respect vastly superior to anything else we have hitherto seen in this line, both as to design and neatness of finish, and are extraordinarily strong; they weigh 7 grammes (about ¼ oz.) the pair, they have a broad flat rim, and are sufficiently strong to land quite large models; the particular pair sent have a diameter of 1·5 ins. The price is 2*d.* each. Under present circumstances it is especially gratifying to note that they have been manufactured throughout by Messrs. Bonn and Co., who have made special tools in order to manufacture them and supply them wholesale to the trade as well as to individuals.

Messrs. Bonn and Co. state that wheels of this description have hitherto been supplied from the Continent, from whence (as so many aeromodelists know) has come a fearful lot of aeronautical rubbish. It is, however, only fair to state that this year (up to the commencement of the war) it had shown, in not a few ways, considerable improvement, and there is no doubt that ere long British model firms would have found the competition very keen. Special attention abroad was being devoted to compressed-air motor plants, more especially to the placing on the market of a complete plant for a pound to thirty shillings which should have a good appearance and work well (for a time). Apart from its frailty and insufficiently good workmanship to stand any really rough usage, the greatest fault of such plants was "leakage"; but they were selling well, because there are plenty of model workers about who would sport one guinea over such a plant, but would hesitate a long time over one costing at least three, even if they were able to afford it at all, and yet we do not see how a really satisfactory plant can be turned out under. If any British firm can do it, so much the better—there is certainly an opening for such. To return to the case in point, these disc wheels are not only vastly superior to their former foreign competitors, but they are no dearer—a fact which is bound to appeal more or less to all.

The B.G. Lubricant.

Some time ago a tube of the above was handed to the writer for the purpose of testing the same and reporting on it. It is, however, only quite recently that an opportunity has arisen for making any experiments with it. The following claims are made for this lubricant: that it tends to preserve the rubber, keeps moist almost indefinitely, and that 75 per cent. more turns can be given than without its use.

With regard to the first claim, all lubricant vendors make it, but we must say that we have never come across any lubricant or, for that matter, anything which enables you to use old rubber—last year's, for instance—for record making in the present year. Lubricants can, no doubt, be said to "preserve" the rubber motor in this way.

Let us assume we are using a rubber motor which we can safely wind again and again to 400 turns unlubricated and 700 if well lubricated. Obviously, we could not use it again and again to 700 unlubricated; in this manner, then, it may be said to "preserve" the rubber.

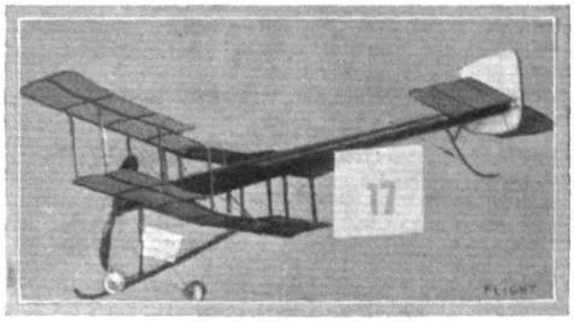
This is not all, however. Some lubricants have, we know, a deleterious effect on rubber, and in the course of a few weeks even, the rubber is rotten. It is only fair to state that such mostly, if not entirely, belong to the past.

If we have a lubricant which has, so far as we can tell, no deleterious effect on the rubber, and which permits us to obtain a very considerable increased number of turns, we should, I think, rest satisfied.

If, in addition to this, the lubricant keeps moist for a long time, and has no tendency (like some lubricants) to stick the strands together after use, then we have a lubricant of yet greater value. Our experience with the above lubricant, we are glad to say, bears out the above. The fact that we had the tube in our possession a good many months before using it also shows that it keeps well, which is still another point in its favour. In one case the lubricant was used on a rubber motor driving a model submarine, the rubber motor working *in* the water; the lubricant was especially successful in this particular case.

In order to increase its elasticity, the pure rubber must be vulcanised before being made into the sheets, some 60 to 80 yards in length, from which the rubber threads are cut; after vulcanisation the substance consists of rubber plus some three per cent. of sulphur. Now, unfortunately, the presence of the sulpher makes the rubber more prone to atmospheric oxidation. Vulcanised rubber, compared then with pure rubber, has but a limited life. And it is, as already stated, to this process of oxidation that the more or less rapid deterioration of rubber is due. It is obvious that to preserve rubber it should be kept from the sun's rays, in a cool place, at as even a temperature as possible, because great extremes of temperature are very harmful to rubber.

It has more than once been suggested to the writer that it should be kept in *water*. The drawback to this, however, appears to be

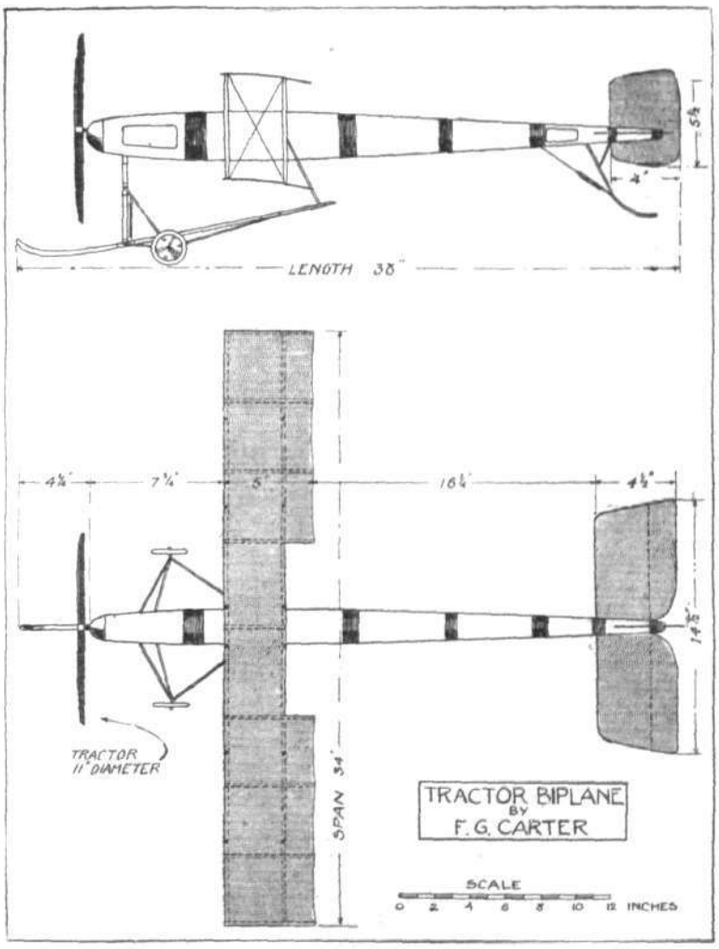


Mr. F. G. Carter's Olympia model.

that although rubber is quite insoluble in water, it will absorb no less than 25 per cent. of water into its pores after soaking for some time. This would have to be squeezed out before using. So far I have not personally found any better method than keeping it in a fairly large air-tight tin, in a cool place.

The chemical composition of the best Para rubber is carbon 87·46 per cent., hydrogen 12·00 per cent., oxygen and ash 0·54 per cent.

Benzol, petroleum, ether, volatile oils, turpentine, naphtha, vaseline, soap and copper (both the metal, oxides and soluble salts)



Drawing to scale of Mr. F. G. Carter's tractor biplane model.

all have a deleterious action on rubber, as well as all oils save castor oil. Redistilled glycerine (if *quite pure*) has but little if any harmful effect; any trace of arsenic or grease left in the glycerine is harmful. The general tendency of the above, as is also the case with bad lubricants, is to reduce, or to tend to reduce, the rubber to a more or less sticky mass. Glycerine, unlike vaseline (a product of petroleum), is not a grease; it is formed from fats by a process known as *saponification*, or treatment of the oil with caustic alkali, which decomposes the compound, forming an alkaline stearate (soap), and liberating the glycerine which remains in solution when the soap is separated by throwing in common salt. In order to obtain pure glycerine, the fat can be decomposed by lead oxide, the glycerine remaining in solution and the lead soap or plaster being precipitated. The little gum ticket on the tube of B.G. lubricant does not tell us, by the way, either the price or where it can be obtained. In conclusion, the lubricant is one which we can cordially recommend.

Two Oft-Repeated Queries.

Quite frequently the following query is sent us:—"I have a model of such and such a span and length, driven by two, or it may be one, propeller of a certain diameter. How many strands of ⅛-in. rubber should I employ to obtain the best results?" Another very frequent one is: Do carved or bent wood propellers give the better results?

Of course there is no difficulty in answering such questions up to a certain point, especially the latter; probably there is not sufficient difference between the respective efficiencies of a well-designed bent wood or carved propeller for it to make any very appreciable difference during the short time that a model is in actual free flight. Bent wood propellers can generally be rendered lighter than carved ones, and have therefore a slight advantage in this way. Some also maintain that they are stronger weight for weight, and probably this is so; but, on the other hand, they must be very carefully and correctly made to keep their shape. They are also successful only in small sizes, and it is extremely doubtful even if the best ones can be designed on really efficient lines or even correctly balanced. Nevertheless, I believe it is a fact that almost all the model records are held by bent wood propellers. The best advice therefore that one can give is to say: Try both and draw your own conclusions.

After all so much depends on the propellers themselves; some can make a propeller of the one type so much better than they can that of the other.

With respect to the other query—the factors which enter into the problem are too many to admit of a reply of any real value. Moreover, never has any correspondent given us sufficient particulars of the machine to enable a proper reply to be made. Often not more than three facts are given, sometimes only two. And yet nothing less than the fullest details are of any real use. The best plan is for any aeromodellist to buy, say, ¼ or ½ lb. of the best rubber and keep it in a large air-tight tin, in a cool place, and find out by actual experiment the amount of rubber which will best serve to make his model execute the desired result, so much depends on the design of the model, to say nothing of workmanship and construction. Begin with a small amount of rubber, and gradually increase until the desired end is obtained. Keep it well lubricated. Always remove it from the machine after every series of flights. Use rubber valve tubing over the metal hooks, and refuse all rubber which will not stretch to *at least* eight times its own length without fracture.

KITE AND MODEL AEROPLANE ASSOCIATION.

Official Notices.

British Model Records.

Single screw, hand-launched	Duration	J. E. Louch	...	95 secs.
Twin screw, do.	Distance	R. Lucas ...	...	590 yards.
	Duration	G. Hayden	...	137 secs.
Single screw, rise off ground	Distance	W. E. Evans	...	290 yards.
	Duration	J. E. Louch	...	68 secs.
Twin screw, do.	Distance	L. H. Slatter	...	365 yards.
	Duration	J. E. Louch	...	2 mins. 49 secs.
Single-tractor screw, hand-launched	Distance	C. C. Dutton	...	266 yards
	Duration	J. E. Louch	...	91 secs.
Do., off-ground	Distance	C. C. Dutton	...	190 yards.
	Duration	J. E. Louch	...	94 secs.
Single screw hydro., off-water	Duration	L. H. Slatter	...	35 secs.
Single-tractor, do., do. ...	Duration	C. C. Dutton	...	29 secs.
Twin screw, do., do. ...	Duration	S. C. Hersom	...	65 secs.
Engine driven off grass ...	Duration	D. Stanger	...	51 secs.

Farrow Shield.—Owing to difficulties having arisen with regard to the measurements the result of this competition will be held over until next week.

Any communications with regard to models should be sent to H. A. Lyche, 46, Templesheen Road, East Sheen, S.W.

AFFILIATED MODEL CLUBS DIARY.

Club reports of chief work done will be published monthly for the future. Secretaries' reports, to be included, must reach the Editor on the last Monday in each month.

Leytonstone and District A.C. (14, LEYTONSTONE RD., STRATFORD)
OCT. 11TH, flying as usual, 10 o'clock. If wet, meet in clubroom.

UNAFFILIATED CLUBS.

Finsbury Park and District (66, ELFORT ROAD, HIGHBURY, N.).
OCT. 10TH, practice flying, Finsbury Park Kite Ground, 3.30 p.m. till dusk.

S. Eastern Model Ae.C. (154, PECKHAM RYE, S.E.)
OCT. 11TH, at 8.30 a.m., flying meeting on Blackheath, and (weather permitting) at the Lee Aerodrome, 10.30 to 12 a.m.

GERMAN SEARCHLIGHTS FOR AERONAUTS.

GERMANY will no doubt possess a very extensive system of high-power signal lights for aeronautical use, and already there are some large-sized searchlights mounted in various places. There is the electric searchlight at the Weimar aviation grounds, of which each flash gives 27,000,000 candle-power. For the use of aviators at a great height there is provided a large light on the top of the Taunus Mountain, at an altitude of 3,000 ft. At present, incandescent lamps give some 500,000 candle-power, but it is intended to use arc light so as to increase this to 50,000,000 candle-power. The revolving light on the top of the wireless mast at the Neustadt station gives four-minute flashes of 300,000 candle-power, using an arc lamp for the purpose. We also note the Berncastel revolving flash, which has 150,000 candle-power. On the Doeberitz military aviation grounds is an acetylene light of 27,000 candle-power, which gives three-minute flashes, while at Kaditz, near Dresden, there is installed an eclipse lamp of 250,000 candle-power, in order to show landing places for aircraft. It gives two flashes in 9 secs. Illuminated numbers of large size are coming into use to show the aircraft headquarters to pilots, and among these is the Johannisthal grounds, which has a number lighted by lamps to the amount of 30,000 candle-power. But larger ones of 85,000 candle-power are mounted at Bonn and at Winiary. Other high-power lights are installed at Konigsberg, Metz, Strasburg and Tegel, and signal lights on the Nauen and Belgerin on the wireless telegraph masts.—*Scientific American.*

Aeronautical Patents Published.

Applied for in 1913.

Published September 24th, 1914.

12,840. W. H. NOSWORTHY AND S. J. PRESCOTT. Waterplane floats.
15,018. W. H. NOSWORTHY AND S. J. PRESCOTT. Hydro-aeroplanes.
25,752. A. LEIB. Flying machines.
29,206. A. E., H. L. AND H. O. SHORT. Hydro-aeroplanes.
29,261. SOC. DITE AEROPLANES HENRY ET MAURICE FARMAN. Hydro-aeroplanes.

Published October 1st, 1914.

28,610. A. E., H. L. AND H. O. SHORT. Biplanes.

Published October 8th, 1914.

18,154. C. LEE AND G. F. T. RICHARDS. Aeroplanes.
22,209. W. A. WEAVER. I.C. engines for aeroplanes, &c.
29,027. A. PEARSE. Flying machines.

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